

Dynamic Multi-Modality Fused Imaging, Analysis, Computer Aided Diagnosis System

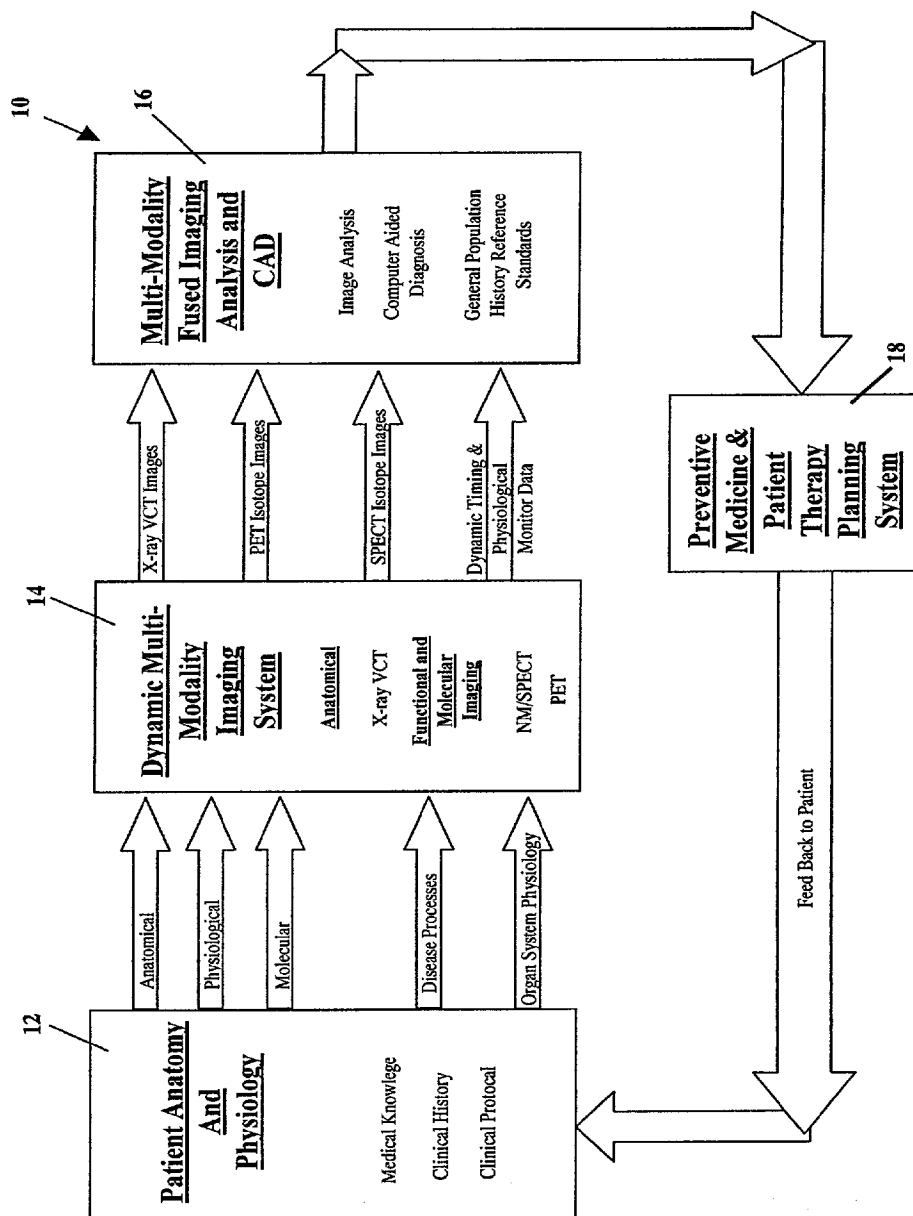


Figure 1



Overall Multi-Modality Imaging System Block Diagram

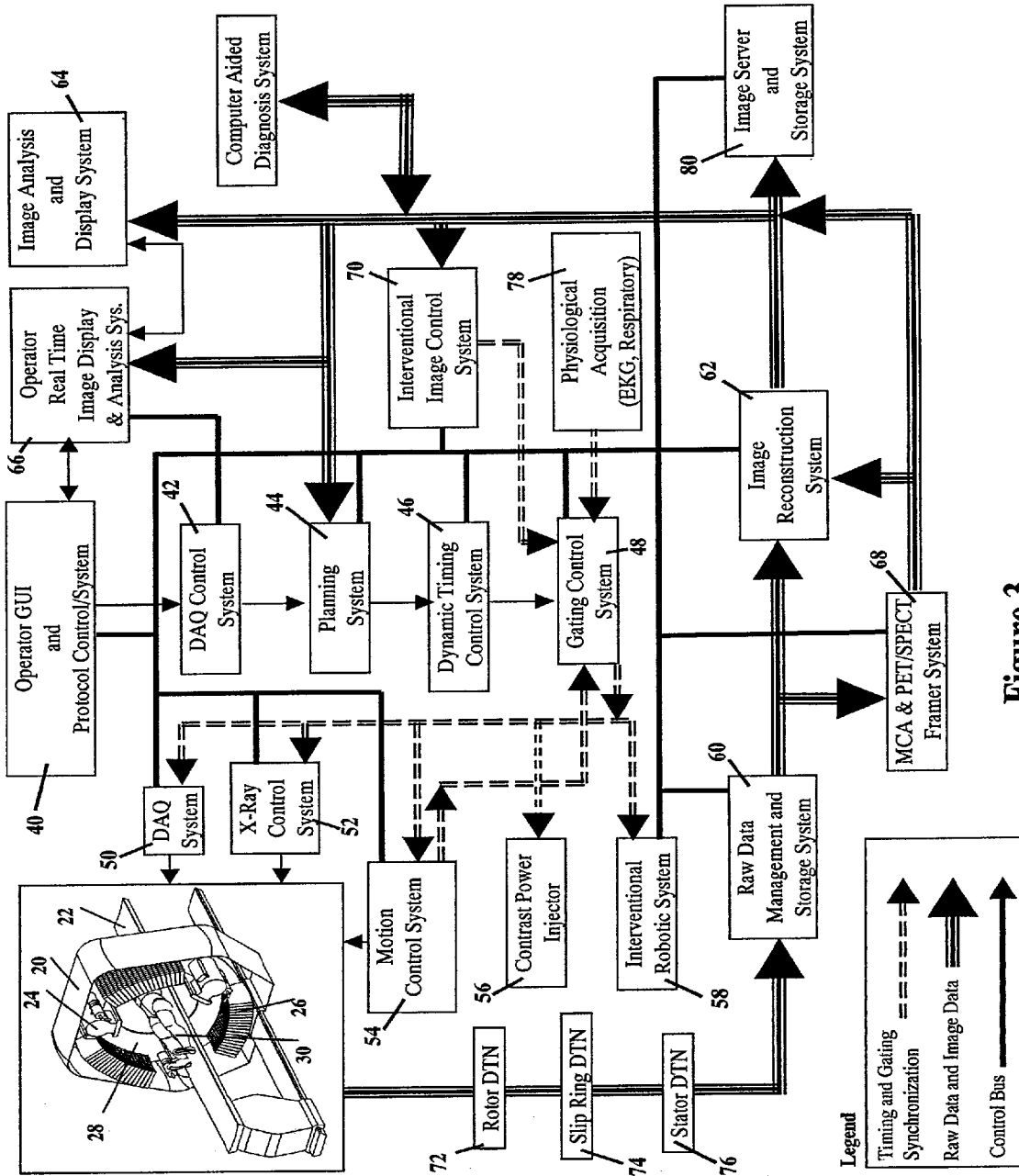


Figure 3

X-ray & Focused 2D Curved Detector Arrangement

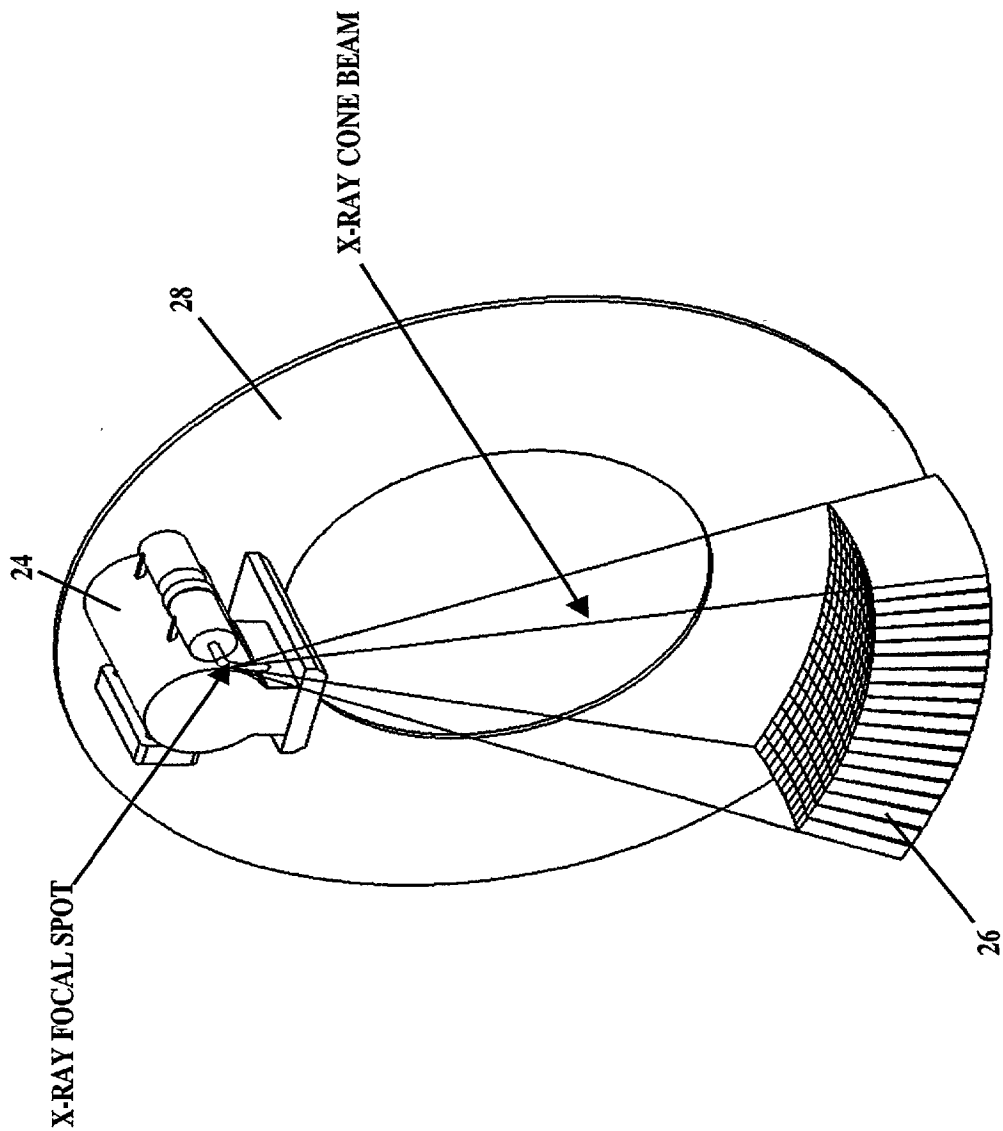


Figure 4

Cone Beam Source Collimation & Cone Beam Shaped Filter

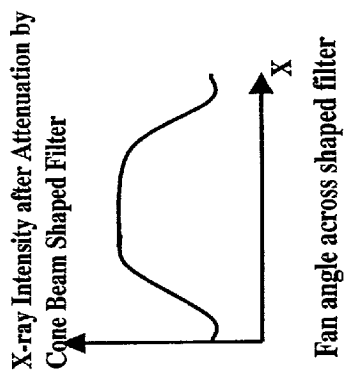
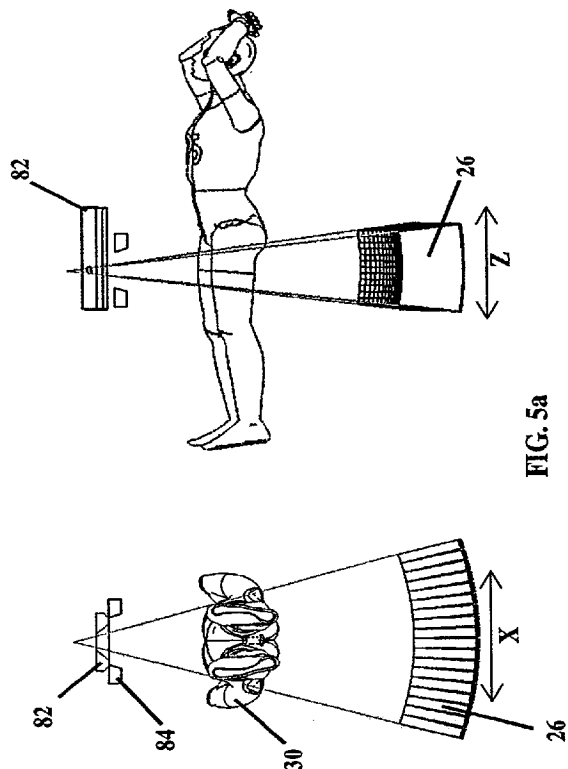


FIG. 5b

Intensity after Attenuation by
Shaped Filter and Patient

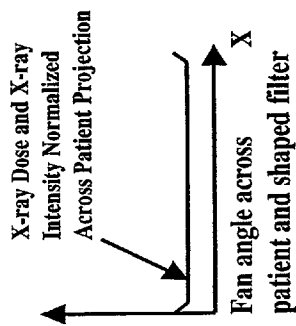


FIG. 5d

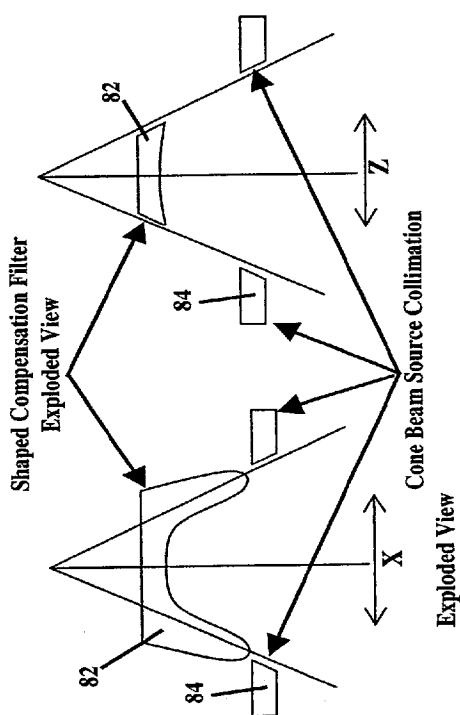


Figure 5

FIG. 5c

X-ray Cone Beam Focal Spot - Curved Detector Optics

Curved Detector to reduce spatial resolution loss and Best Conversion efficiency of X-ray

Focal spot from V-groove Type Anode has similar spot size appearance

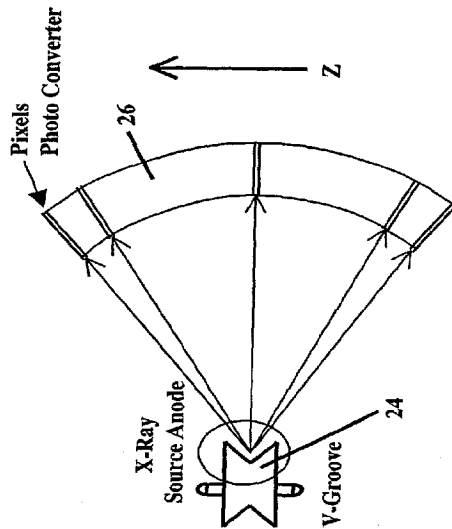


FIG. 6a

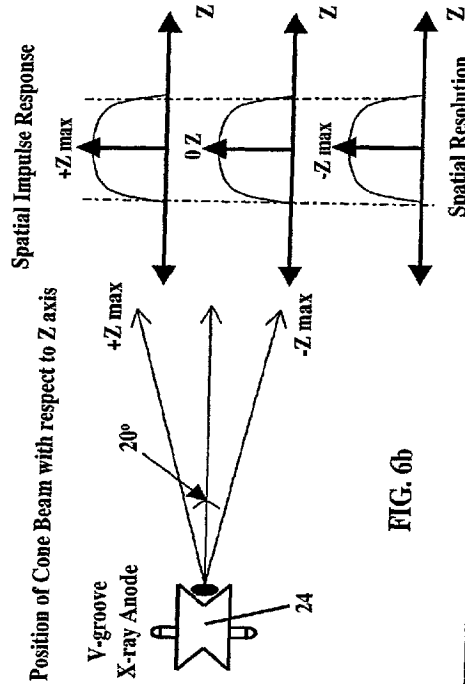


FIG. 6b

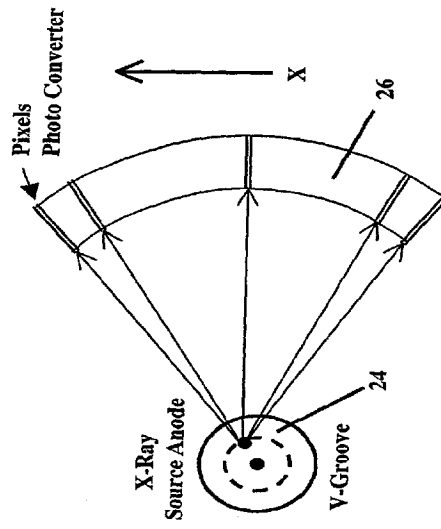


FIG. 6c

Figure 6

Spatial Resolution

X-ray Focal Spot Geometric Dithering For Doubling the Spatial Sampling Rate



Spatial Resolution comparison between Single Sampling and 2X Dither Sampling

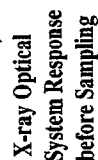
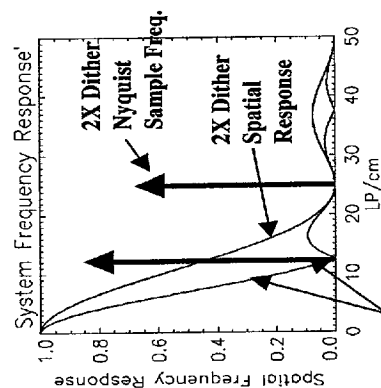


Figure 7e

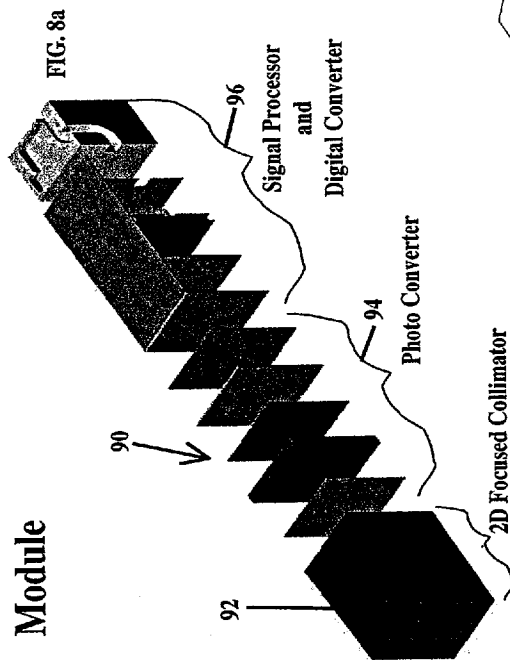


**Normal Nyquist Sample
Freq. & aliased optical
response**

Figure 7

Focused 2D Curved Detector Module

Focused Curved Detector Module



View Showing Focused 2D Anti-scatter Collimation with 2D Focused Pixels

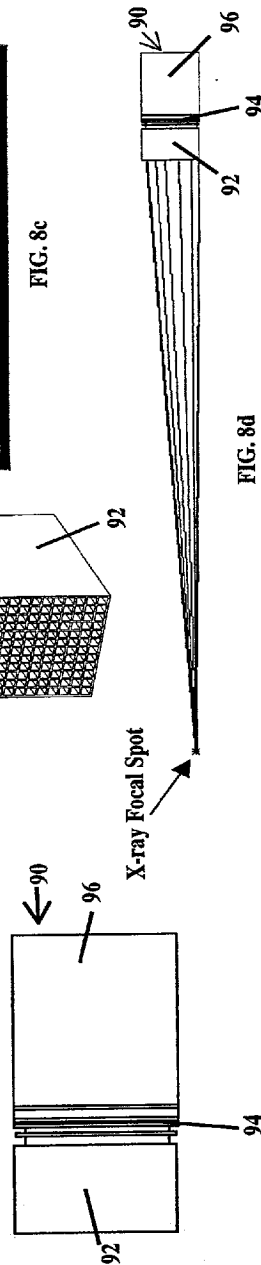
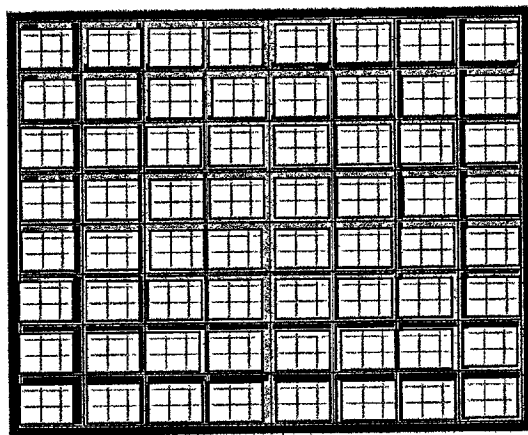


FIG. 8b

Figure 8

Focused 2D Area Detector with Adaptive Shaped X-Ray Optical Response

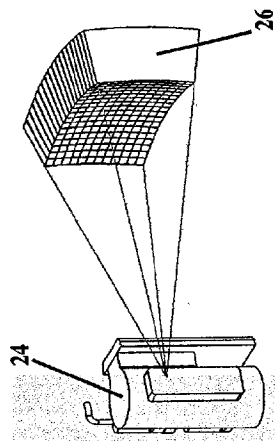
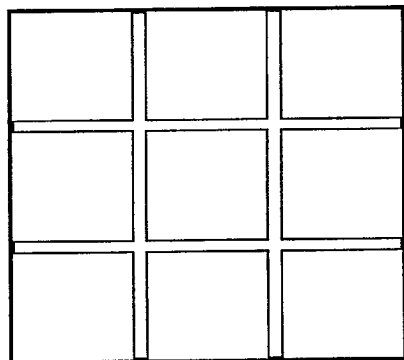
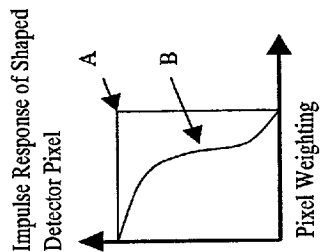


FIG. 9a

Impulse Response Shaping from Rectangular to Variable gaussian Roll-off Function. Shaping may be Fixed or Controlled



Detector Pixel
FIG. 9b



1	1	1
1	1	1
1	1	1

A

.2	.44	.2
.44	1	.44
.2	.44	.2

B

FIG. 9f

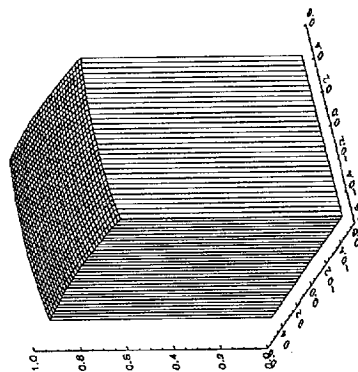


FIG. 9c

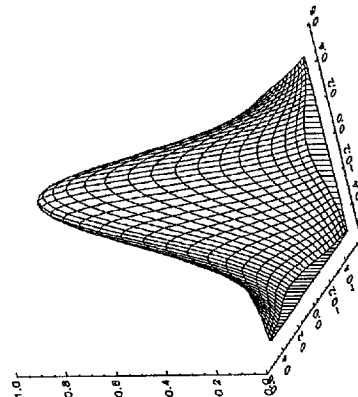


FIG. 9d

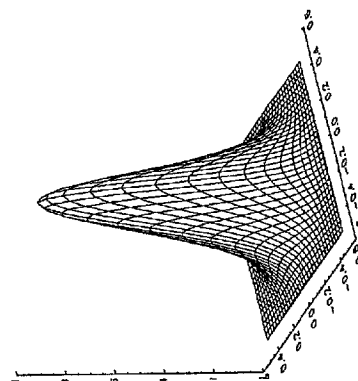
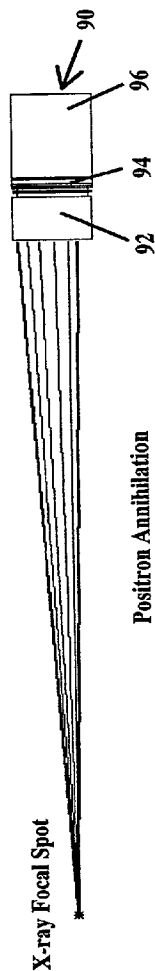


FIG. 9e

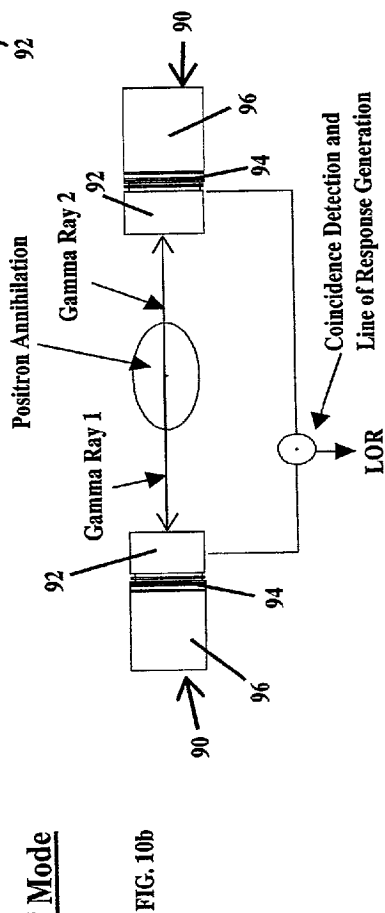
Figure 9

Multi-Modality XGA Detector Module

X-Ray Mode



PET Mode



NM/SPECT Mode

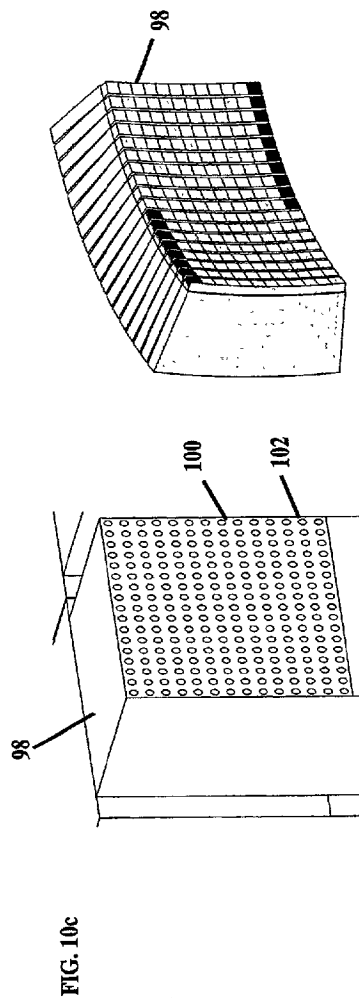


Figure 10

Detector Module Multi-Modality Collimation

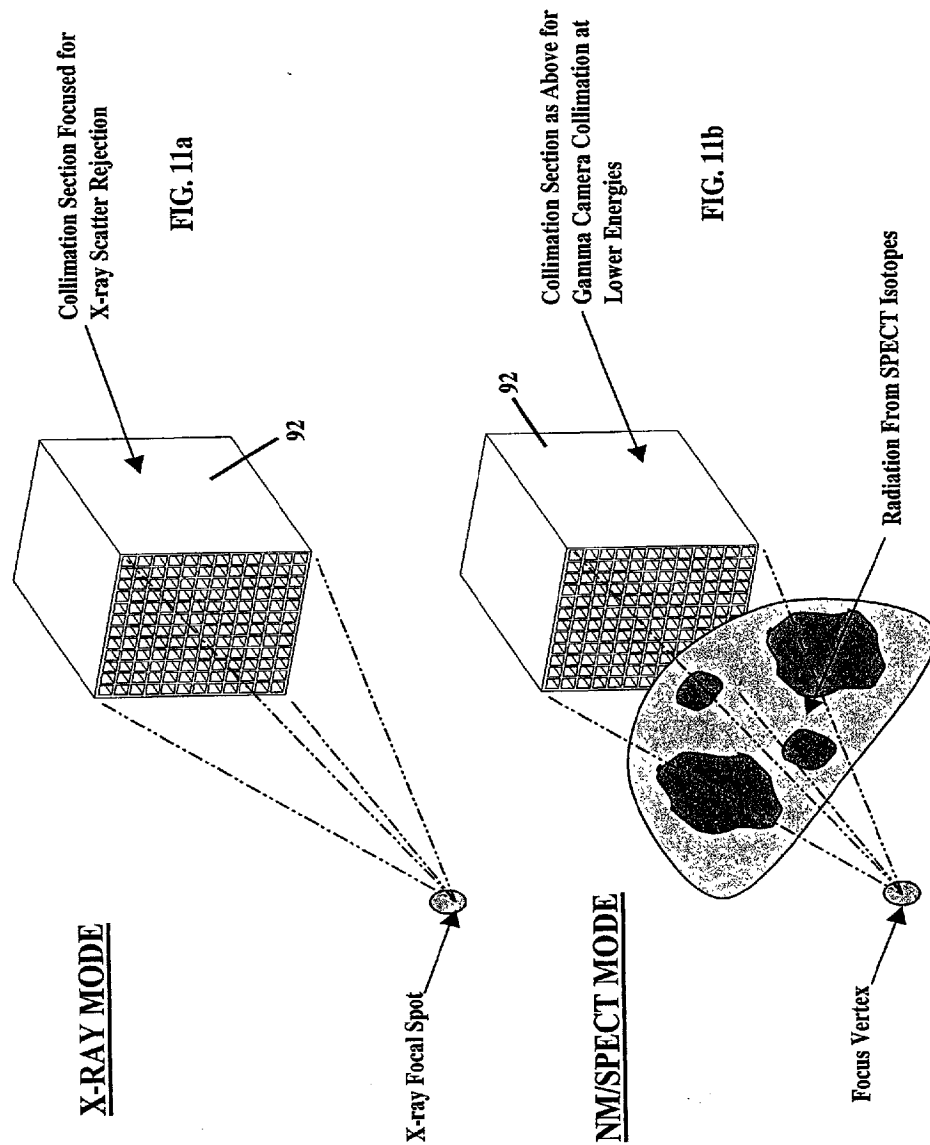
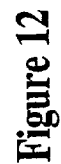


Figure 11



System with Optional PET Anti-Scatter Baffle

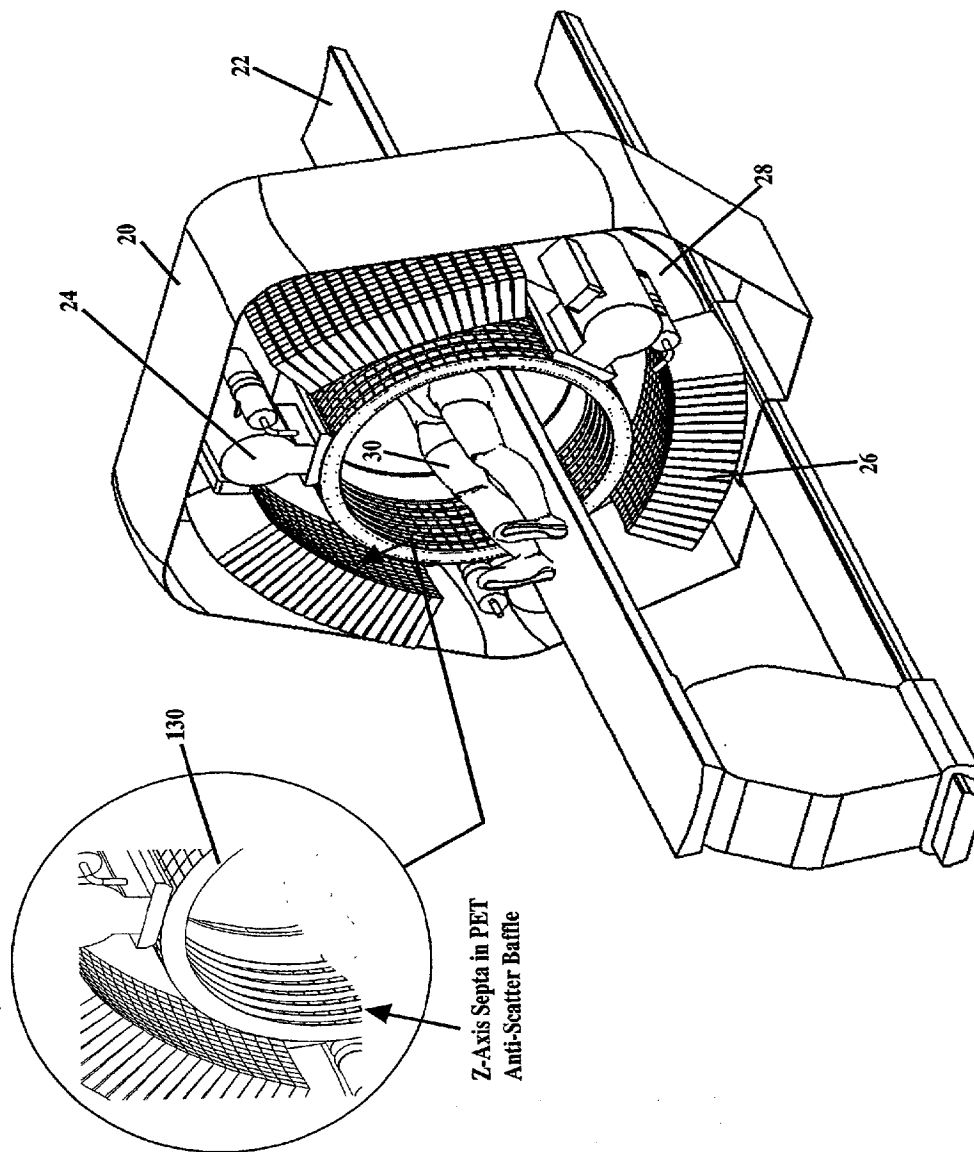


Figure 13

PET – Anti-Scatter Baffle SEPTA

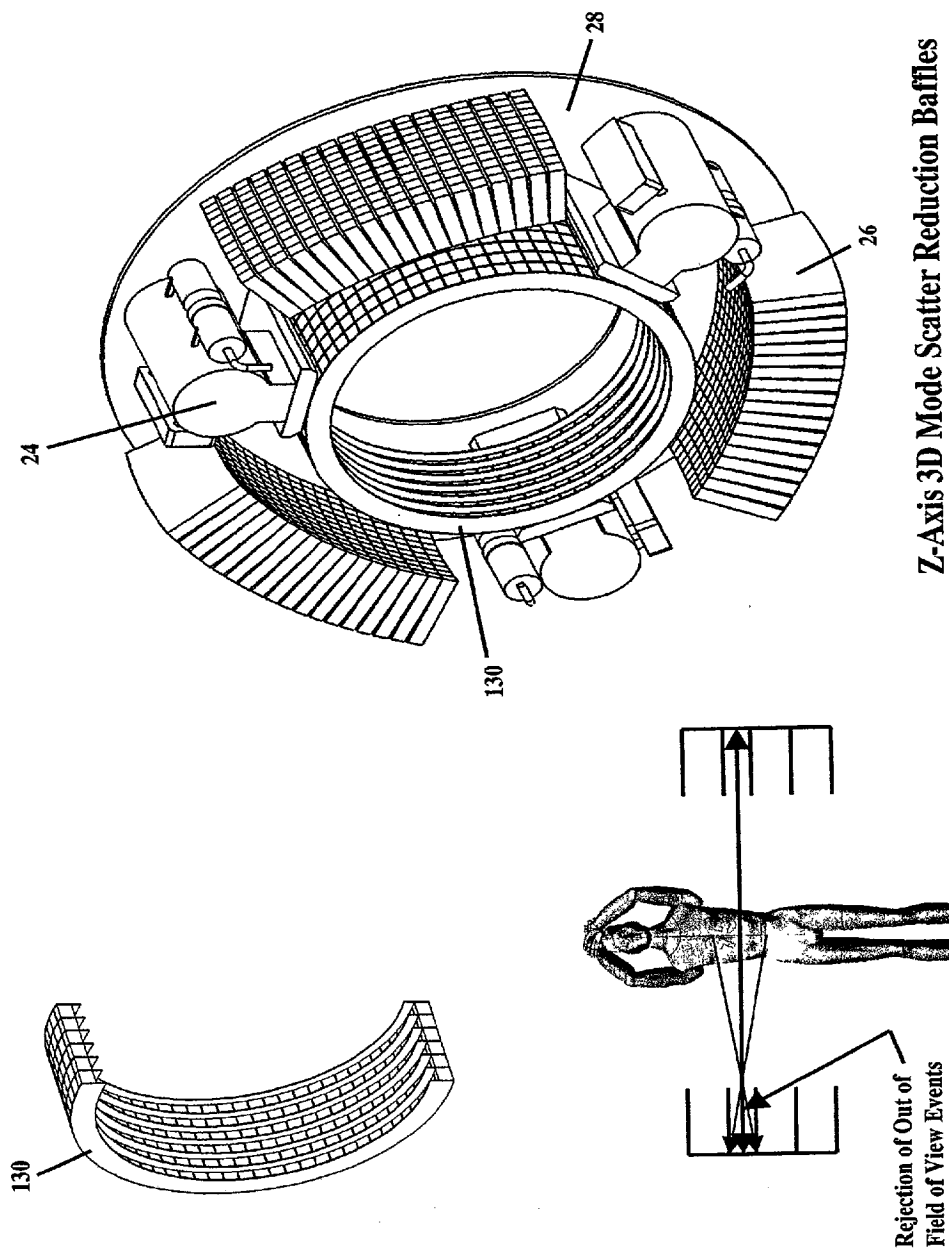


Figure 14

System With Cone Beam Focused NM/SPECT Collimation

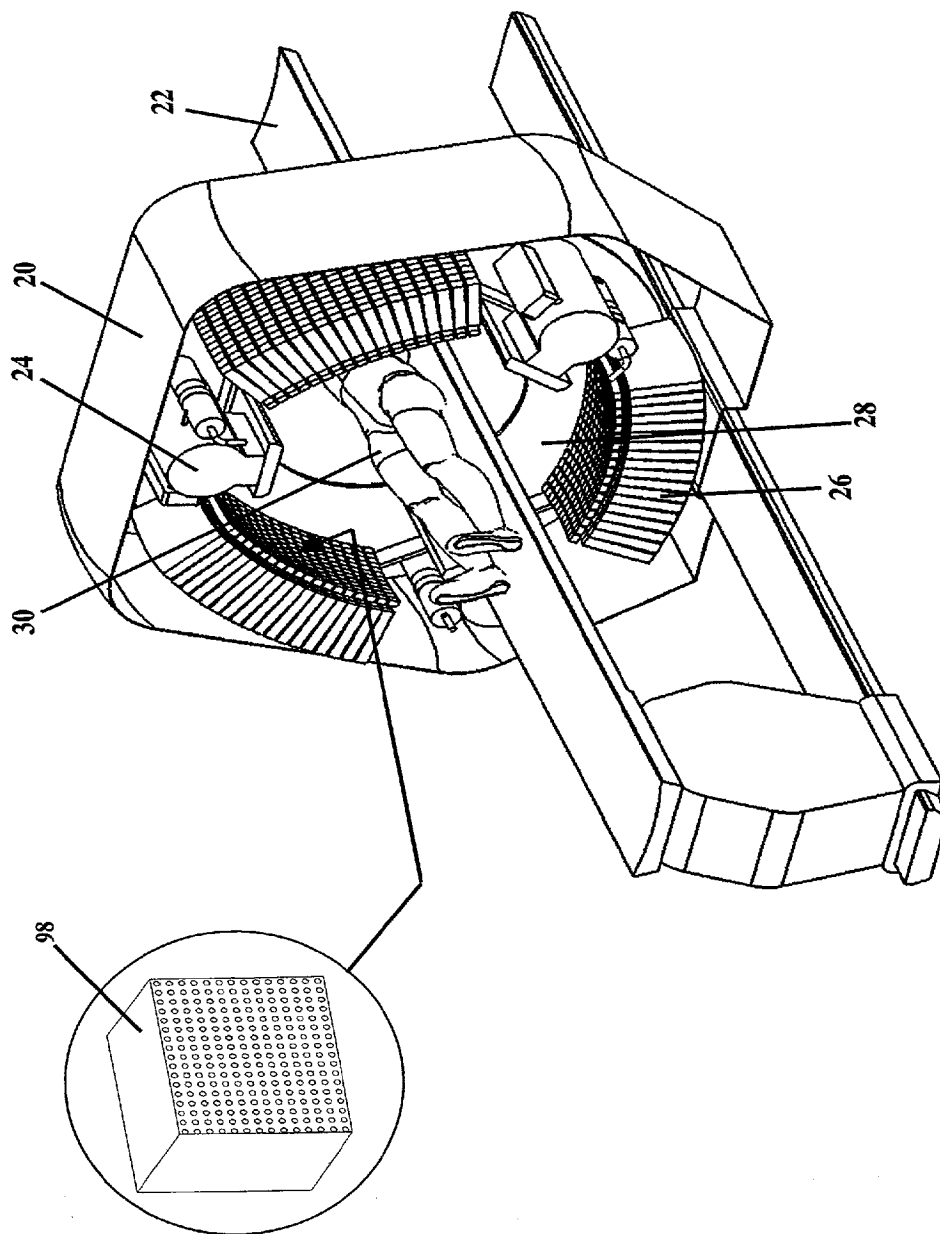


Figure 15

NM/SPECT Mode with Collimation Ring

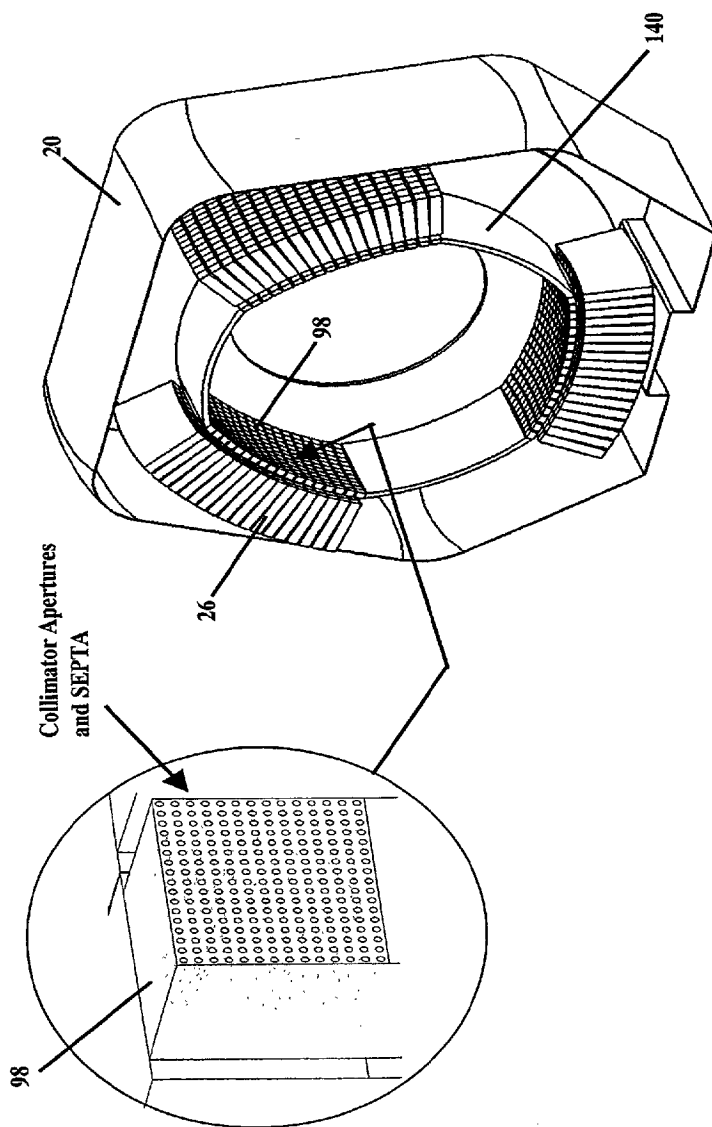


Figure 16

Cone Beam NM/SPECT LEHR Collimation and Focused 2D Curved

Detector Array

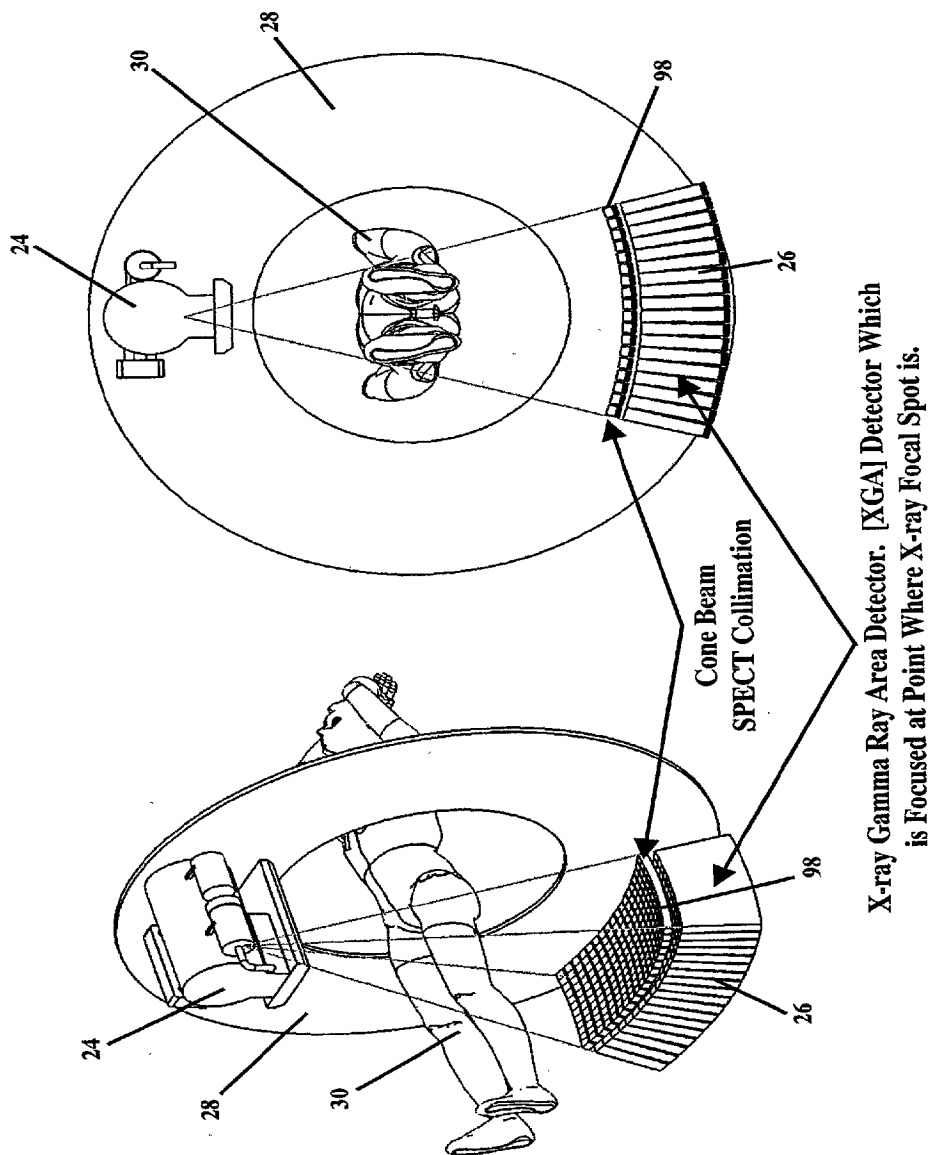
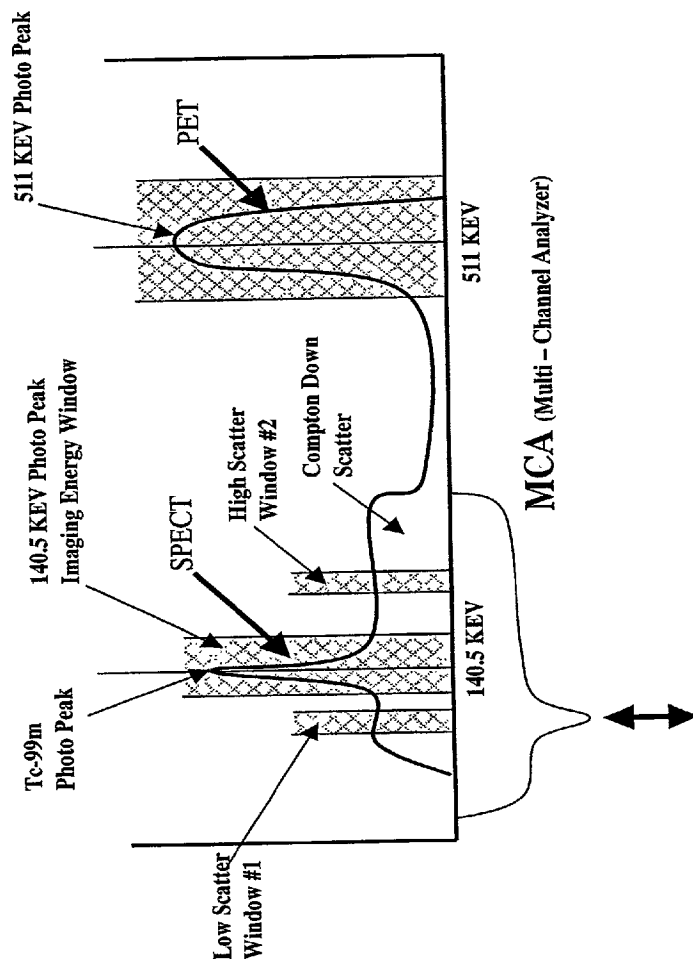


Figure 17

Multi-Isotope Scanning



- Scatter Correction and 511 KEV Photo Peak Suppression for SPECT Imaging
- NM/SPECT Detector Must Function with 511 KEV Isotope Present for Multi-Isotope Imaging

Figure 18

Figure 19

Sequencing of X-ray Sources for Adaptive Scatter Correction

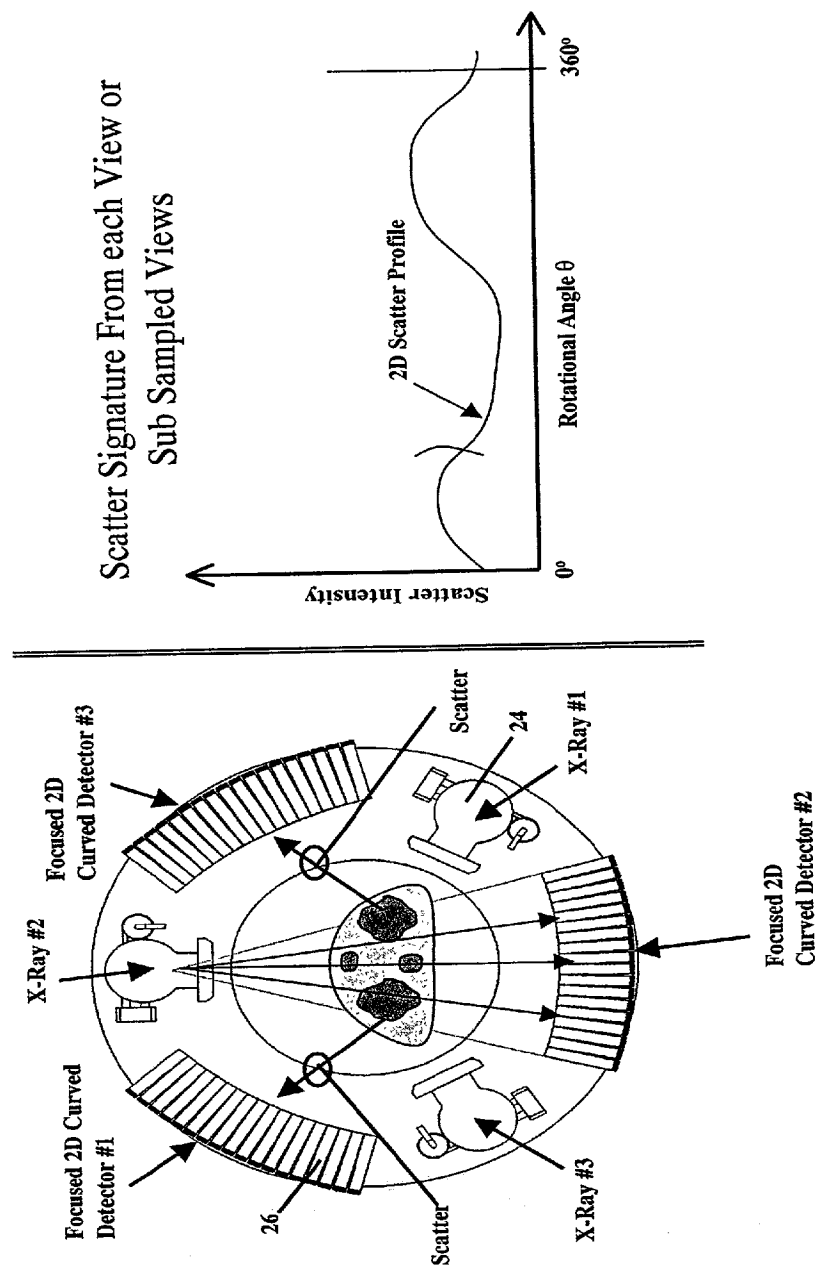


Figure 20

Modulation and Demodulation for Scatter Correction with Multiple Sources

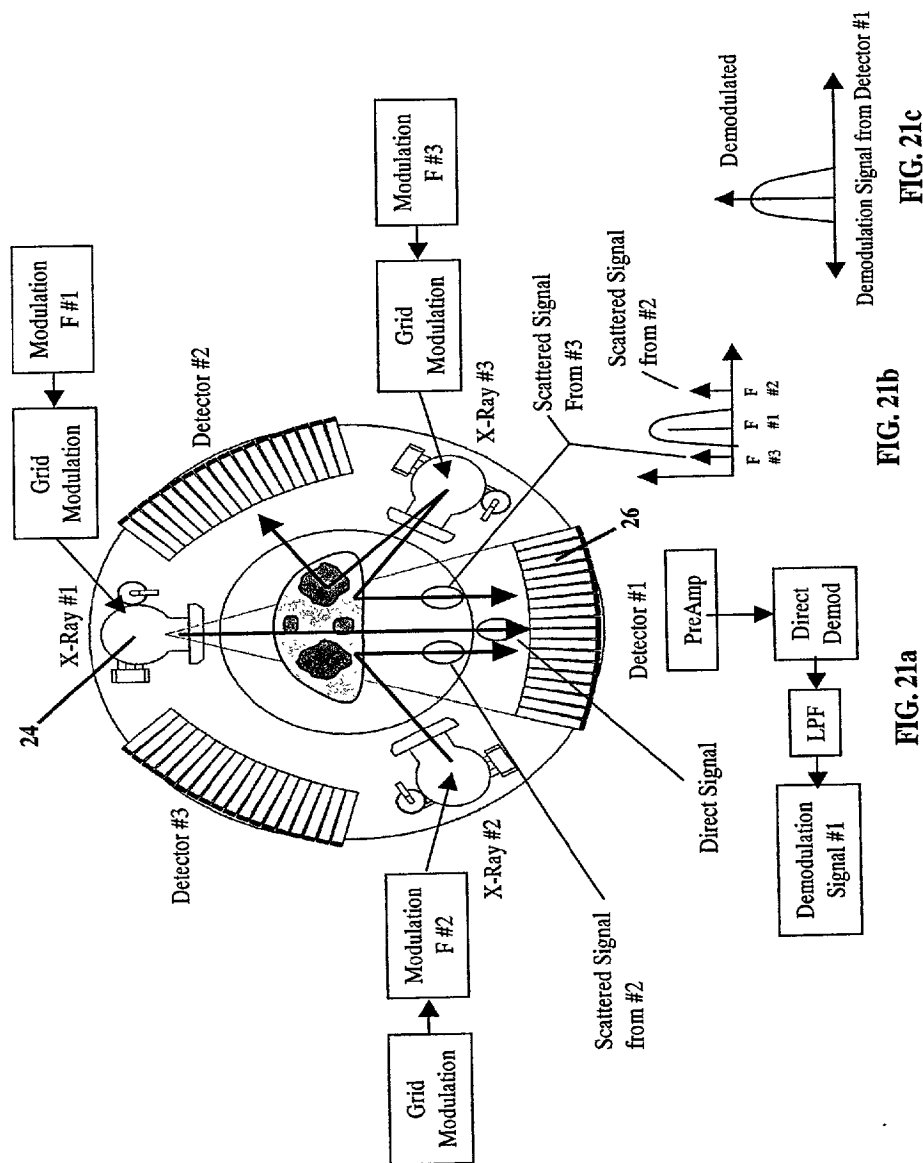


Figure 21

System Level Diagram of Modulation and Demodulation For Multiple Sources for VCT

Sources for VCT

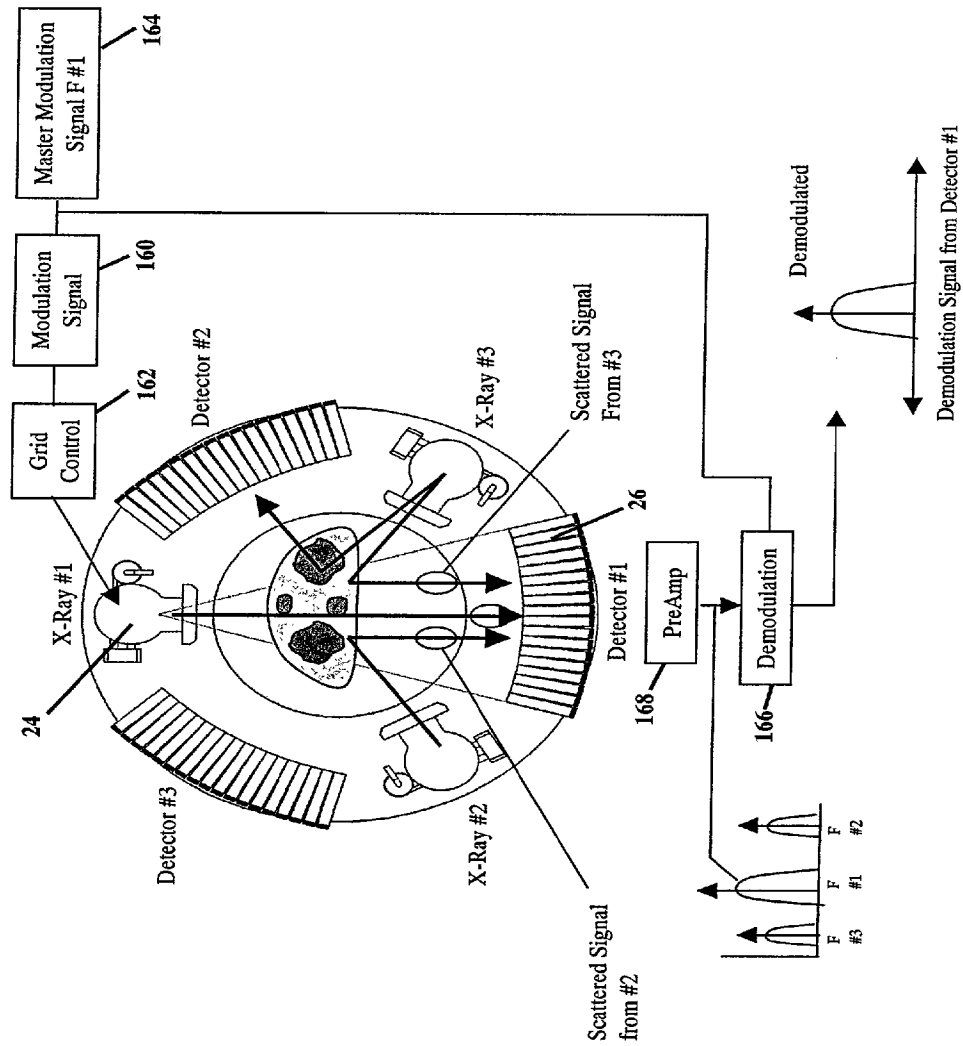


Figure 22

Step and Shoot VCT Imaging

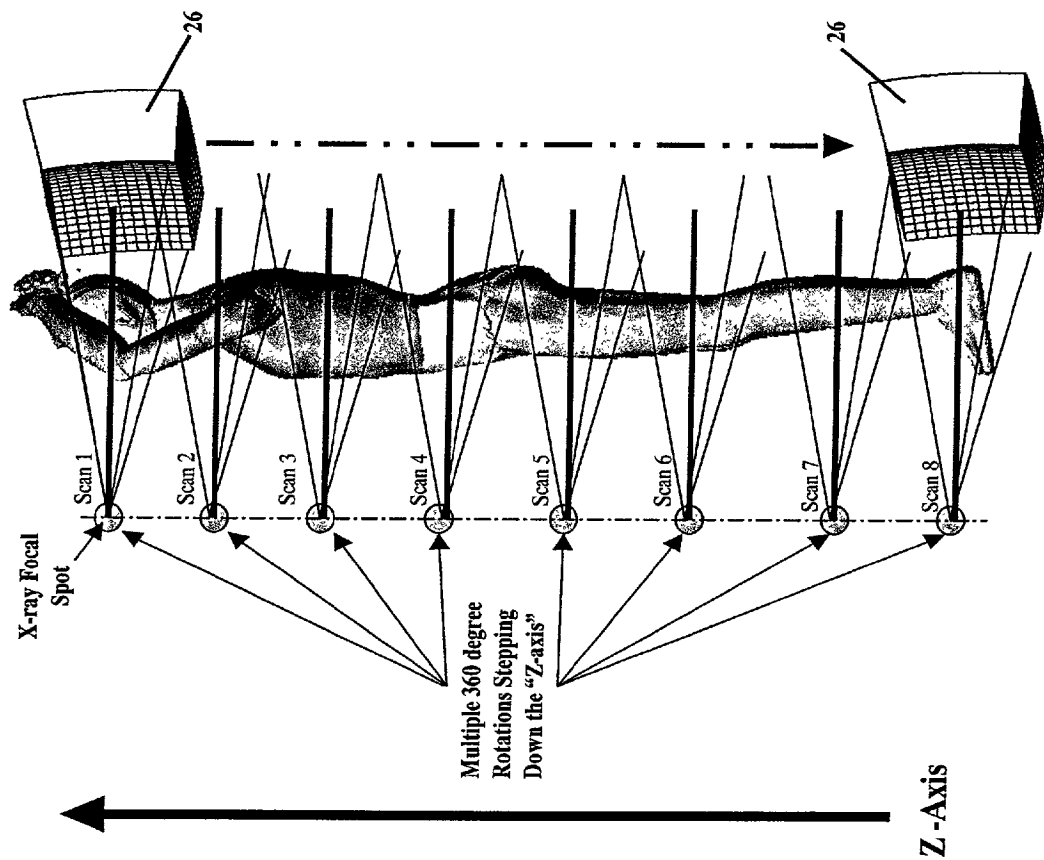
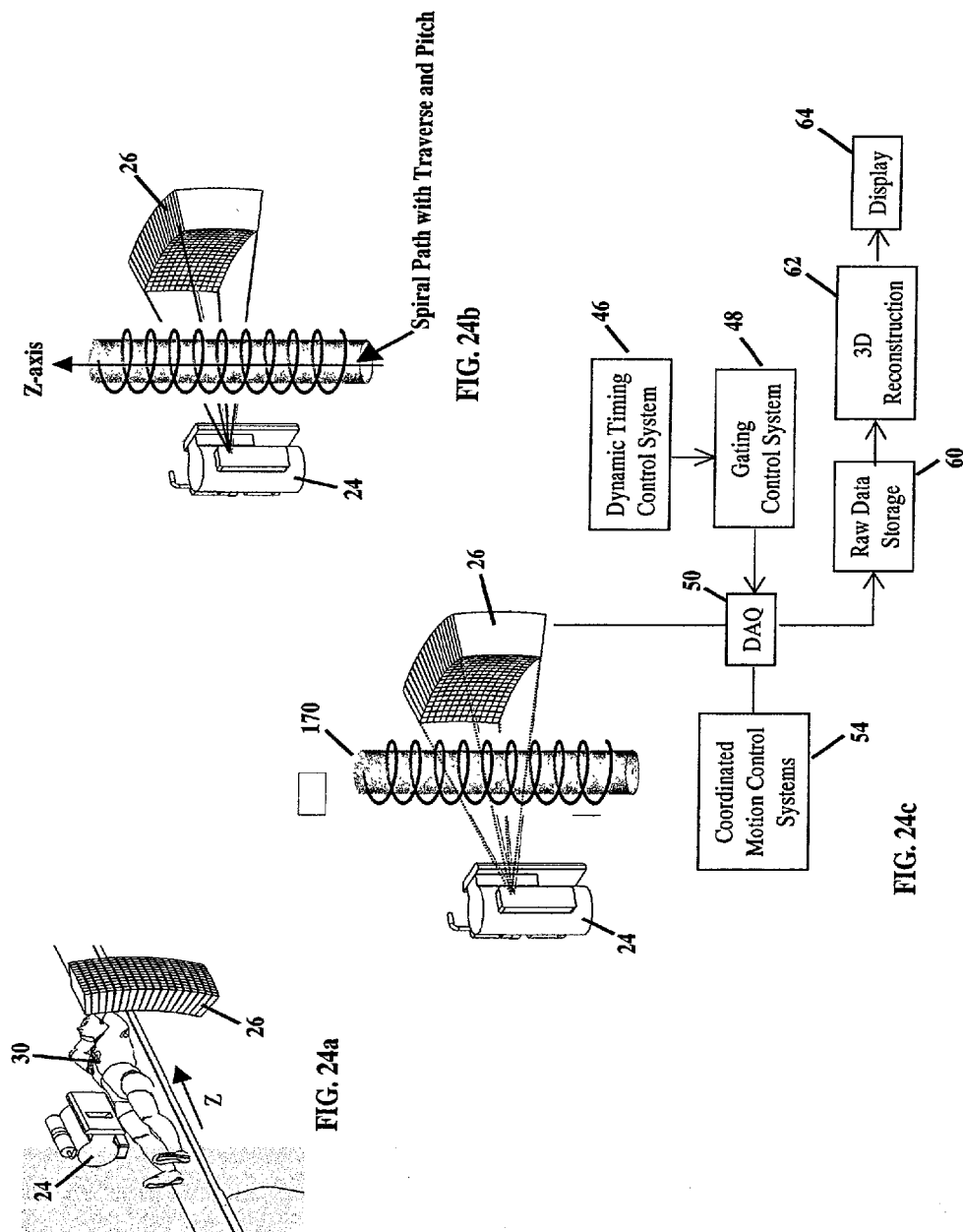
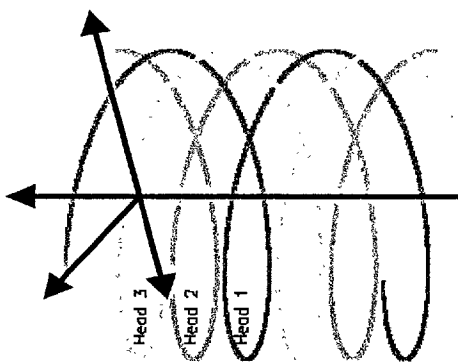
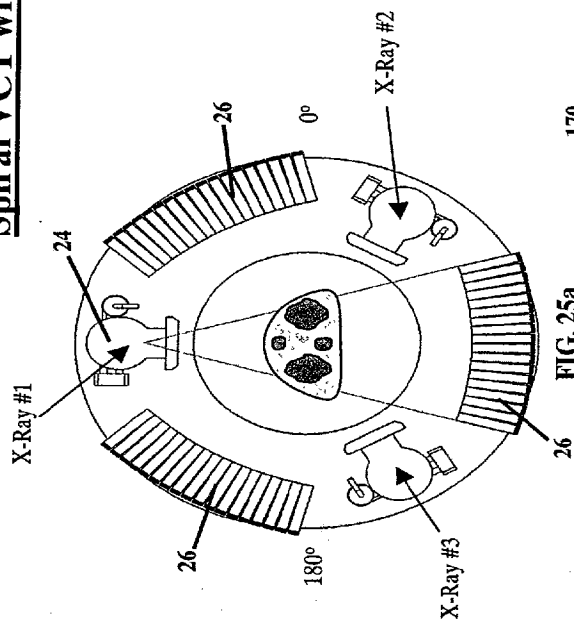


Figure 23

Spiral 3D X-Ray, DAQ and VCT for Cone Beam Reconstruction



Spiral VCT with Multiple Heads



Spiral Path with 3 Heads with
respective Central Rays on
Reconstruction Cylinder

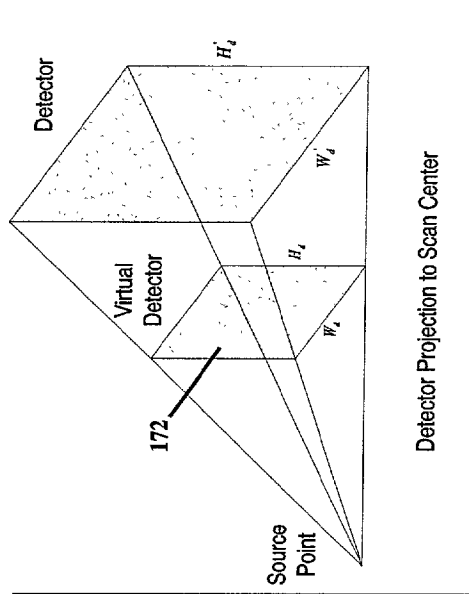
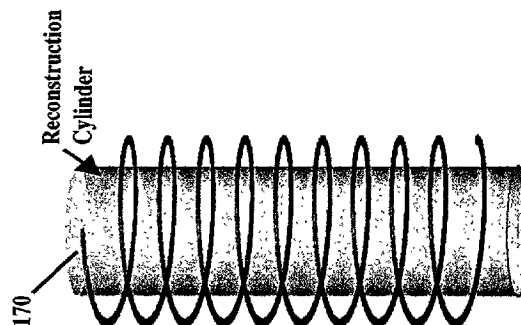


FIG. 25c

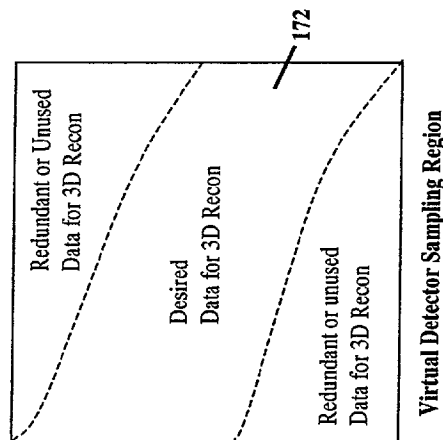


FIG. 25d

Figure 25

Cone Beam Slant Source Collimation for Spiral VCT Imaging

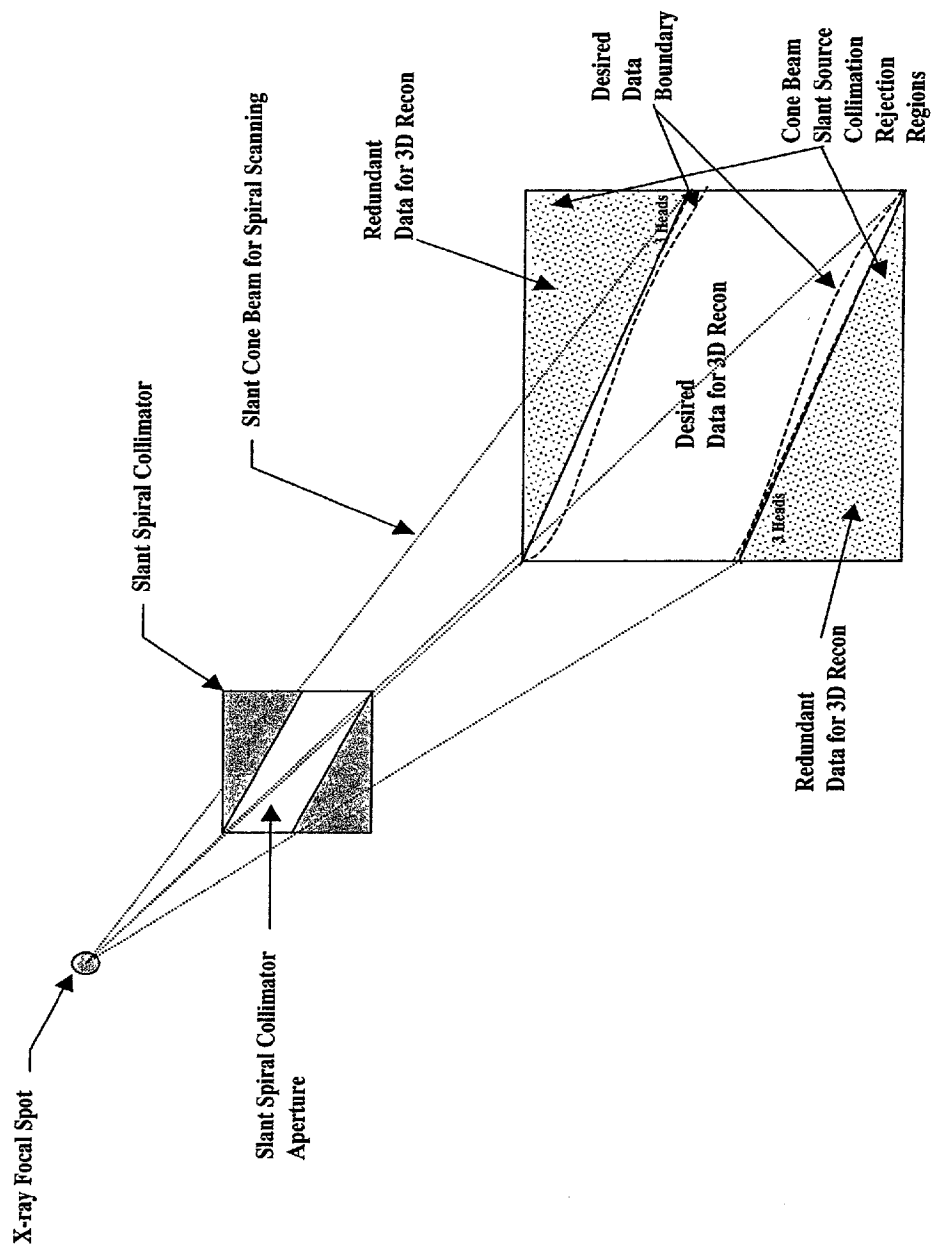


Figure 26

Multi-Plane Planning System Imaging

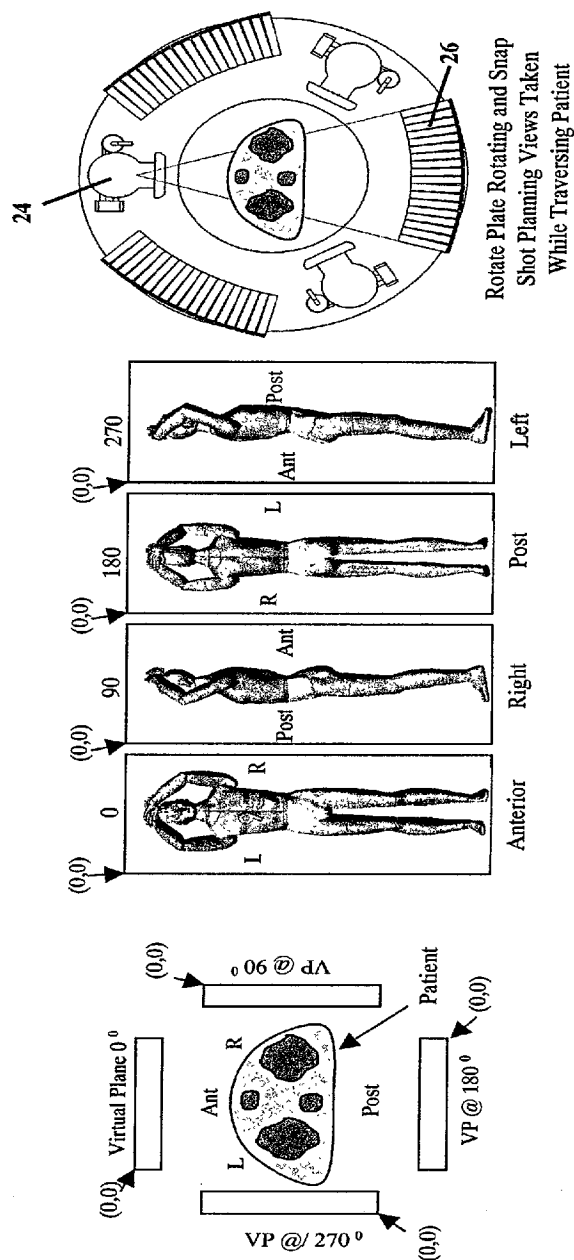


Figure 27

Whole Body Dose Control From Planning System

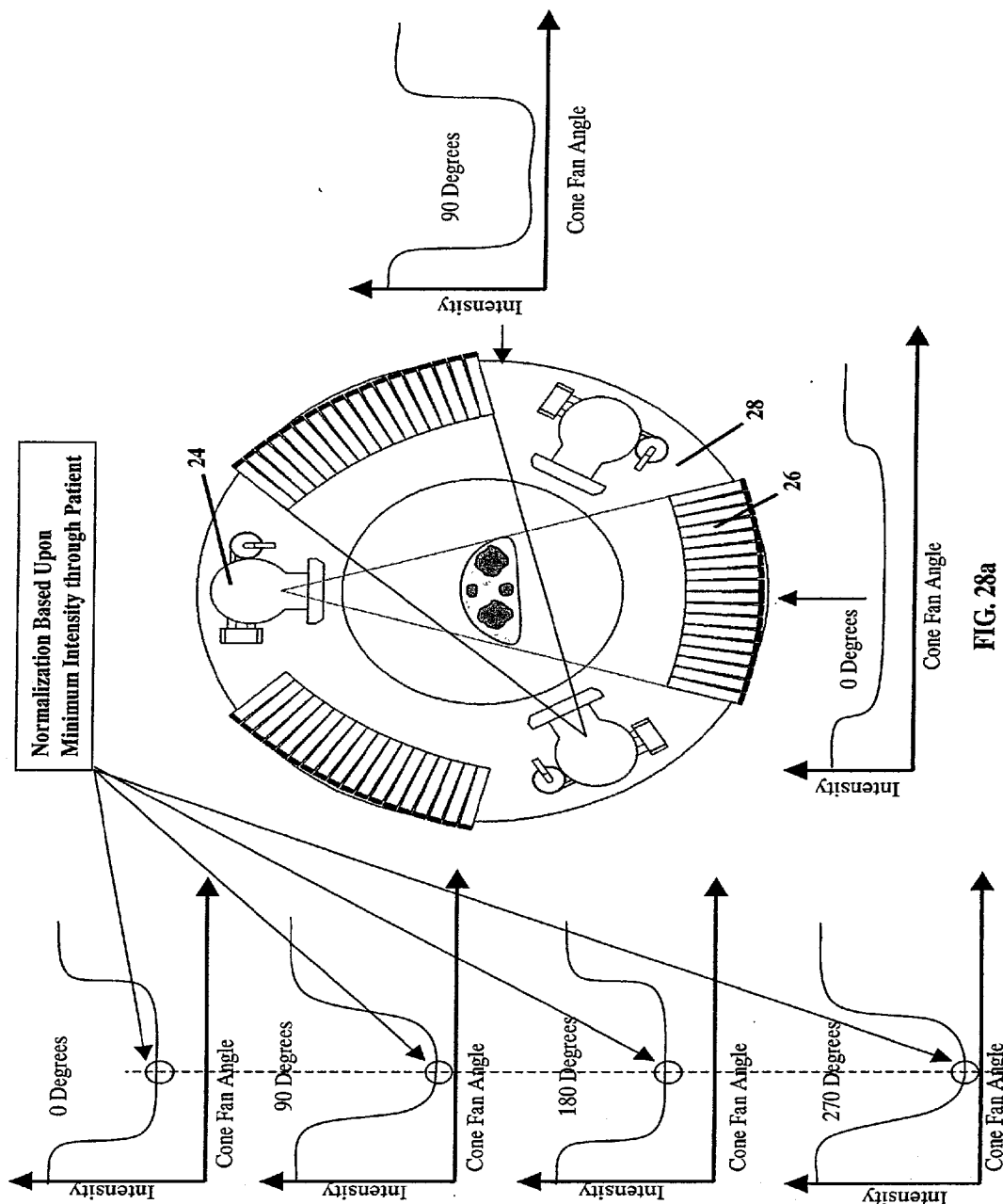


FIG. 28a

Figure 28

FIG. 28b

Dynamic Timing Control

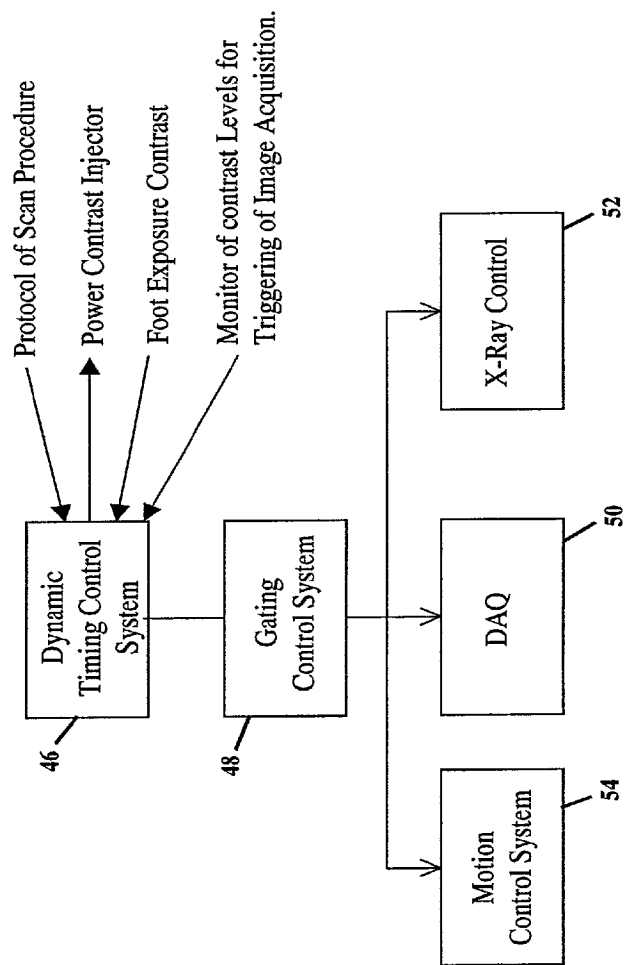


Figure 29

Retrospective Gated Imaging System

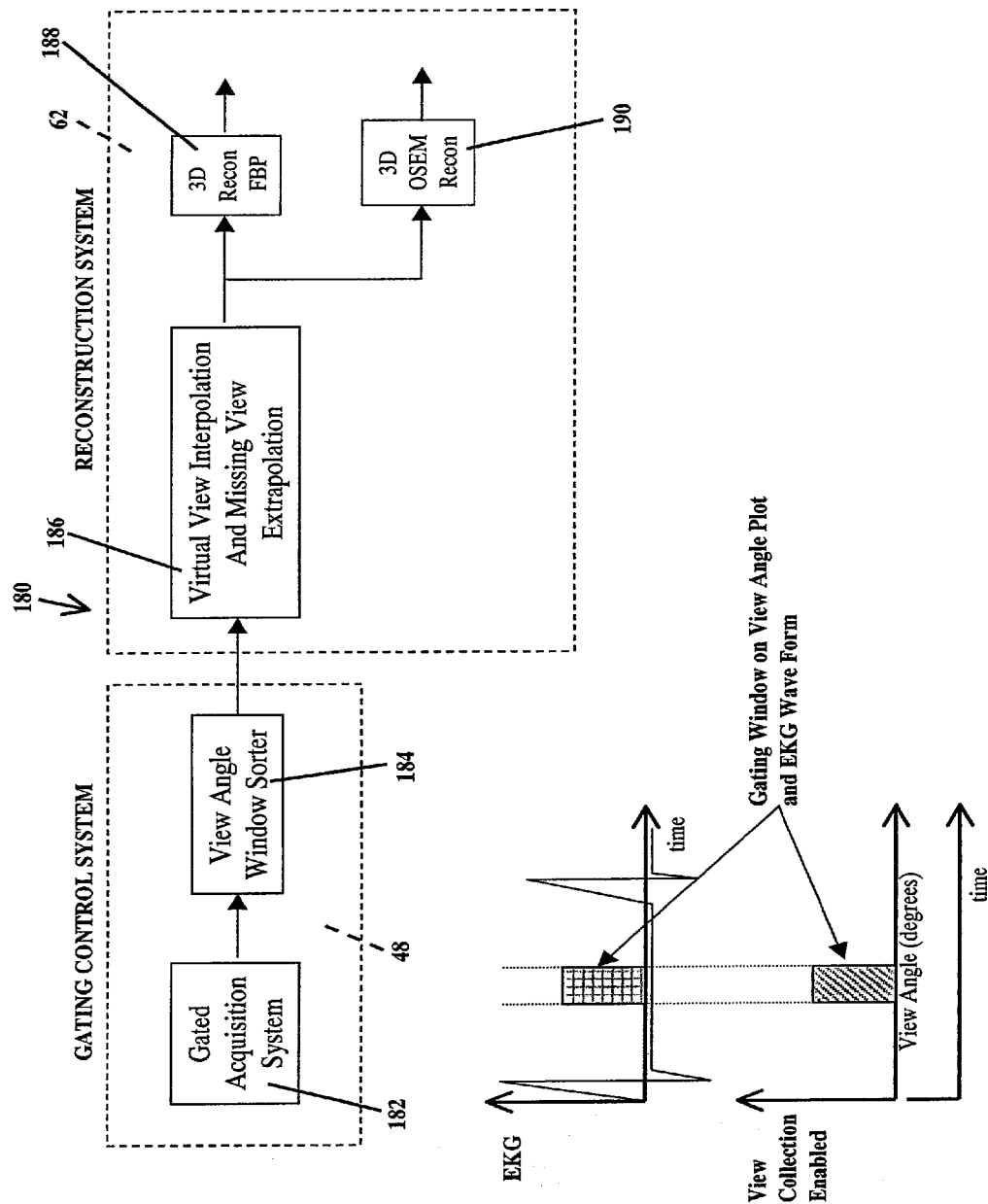


Figure 30

Prospective Gating Control System with Cardiac EKG

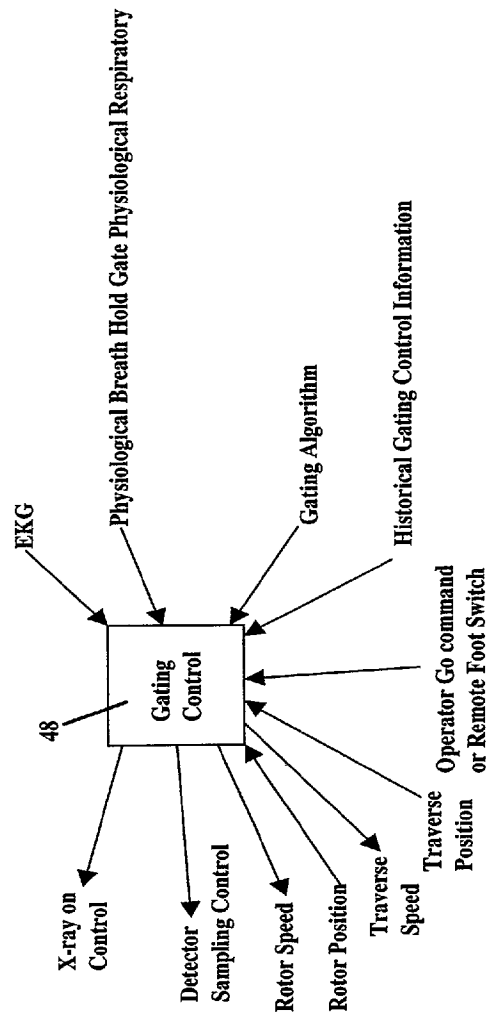
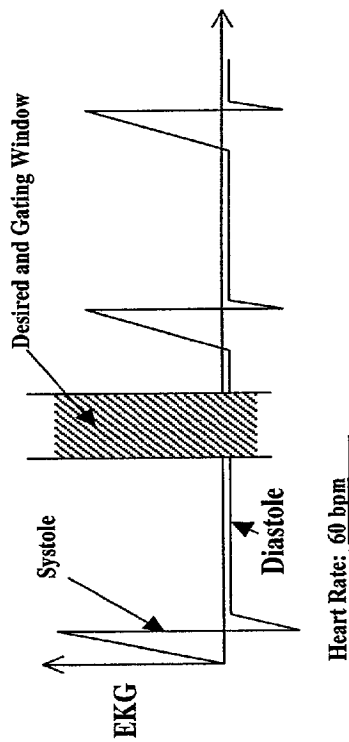


Figure 31

Symbol	Value	Symbol	Value	Symbol	Value	Symbol	Value
α_1	0.015	α_2	0.001	α_3	0.003	α_4	0.015
β_1	0.015	β_2	0.001	β_3	0.003	β_4	0.015
γ_1	0.015	γ_2	0.001	γ_3	0.003	γ_4	0.015
δ_1	0.015	δ_2	0.001	δ_3	0.003	δ_4	0.015
ϵ_1	0.015	ϵ_2	0.001	ϵ_3	0.003	ϵ_4	0.015
ζ_1	0.015	ζ_2	0.001	ζ_3	0.003	ζ_4	0.015
η_1	0.015	η_2	0.001	η_3	0.003	η_4	0.015
θ_1	0.015	θ_2	0.001	θ_3	0.003	θ_4	0.015
ι_1	0.015	ι_2	0.001	ι_3	0.003	ι_4	0.015
κ_1	0.015	κ_2	0.001	κ_3	0.003	κ_4	0.015
λ_1	0.015	λ_2	0.001	λ_3	0.003	λ_4	0.015
μ_1	0.015	μ_2	0.001	μ_3	0.003	μ_4	0.015
ν_1	0.015	ν_2	0.001	ν_3	0.003	ν_4	0.015
ξ_1	0.015	ξ_2	0.001	ξ_3	0.003	ξ_4	0.015
π_1	0.015	π_2	0.001	π_3	0.003	π_4	0.015
ρ_1	0.015	ρ_2	0.001	ρ_3	0.003	ρ_4	0.015
σ_1	0.015	σ_2	0.001	σ_3	0.003	σ_4	0.015
τ_1	0.015	τ_2	0.001	τ_3	0.003	τ_4	0.015
υ_1	0.015	υ_2	0.001	υ_3	0.003	υ_4	0.015
ϕ_1	0.015	ϕ_2	0.001	ϕ_3	0.003	ϕ_4	0.015
χ_1	0.015	χ_2	0.001	χ_3	0.003	χ_4	0.015
ψ_1	0.015	ψ_2	0.001	ψ_3	0.003	ψ_4	0.015
ω_1	0.015	ω_2	0.001	ω_3	0.003	ω_4	0.015
η_1	0.015	η_2	0.001	η_3	0.003	η_4	0.015
θ_1	0.015	θ_2	0.001	θ_3	0.003	θ_4	0.015
ι_1	0.015	ι_2	0.001	ι_3	0.003	ι_4	0.015
κ_1	0.015	κ_2	0.001	κ_3	0.003	κ_4	0.015
λ_1	0.015	λ_2	0.001	λ_3	0.003	λ_4	0.015
μ_1	0.015	μ_2	0.001	μ_3	0.003	μ_4	0.015
ν_1	0.015	ν_2	0.001	ν_3	0.003	ν_4	0.015
ξ_1	0.015	ξ_2	0.001	ξ_3	0.003	ξ_4	0.015
π_1	0.015	π_2	0.001	π_3	0.003	π_4	0.015
ρ_1	0.015	ρ_2	0.001	ρ_3	0.003	ρ_4	0.015
σ_1	0.015	σ_2	0.001	σ_3	0.003	σ_4	0.015
τ_1	0.015	τ_2	0.001	τ_3	0.003	τ_4	0.015
υ_1	0.015	υ_2	0.001	υ_3	0.003	υ_4	0.015
ϕ_1	0.015	ϕ_2	0.001	ϕ_3	0.003	ϕ_4	0.015
χ_1	0.015	χ_2	0.001	χ_3	0.003	χ_4	0.015
ψ_1	0.015	ψ_2	0.001	ψ_3	0.003	$\psi_4</$	

FIG. 32b

Multi Cycle – Contiguous

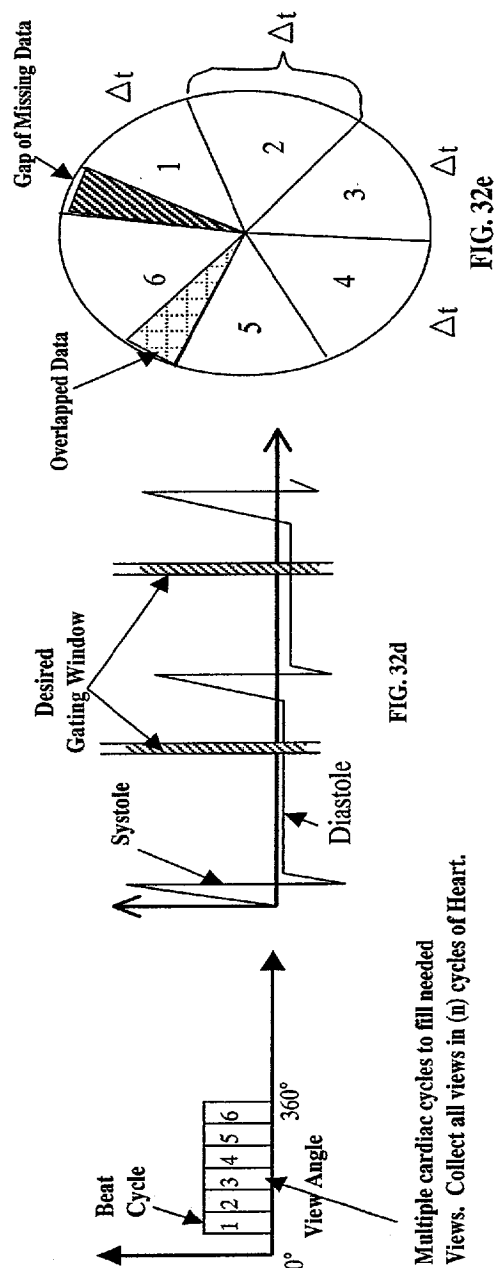


Figure 32

Gated DAQ and Reconstruction for Retrospective Cine' Dynamic Cardiac Imaging

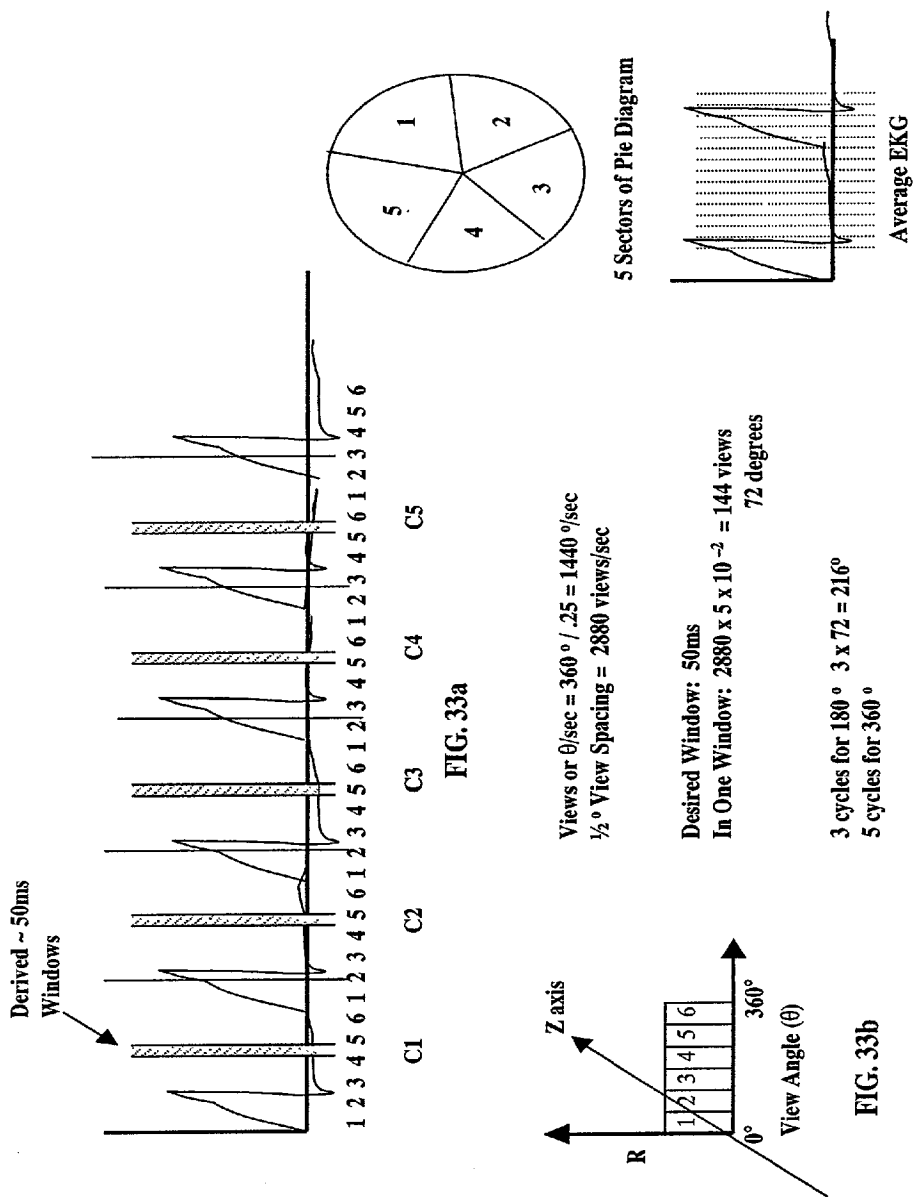
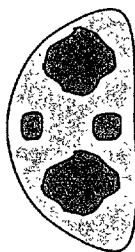


Figure 33

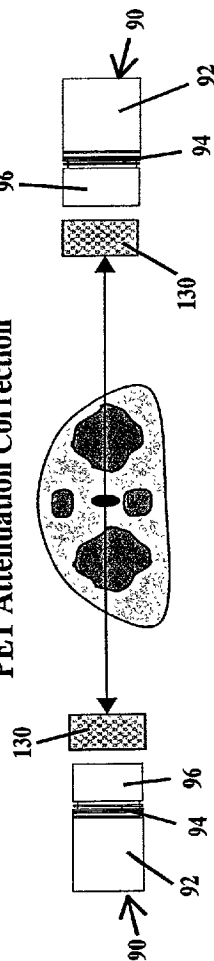
PET Transmission, Attenuation & Scatter Correction

VCT Attenuation MAP



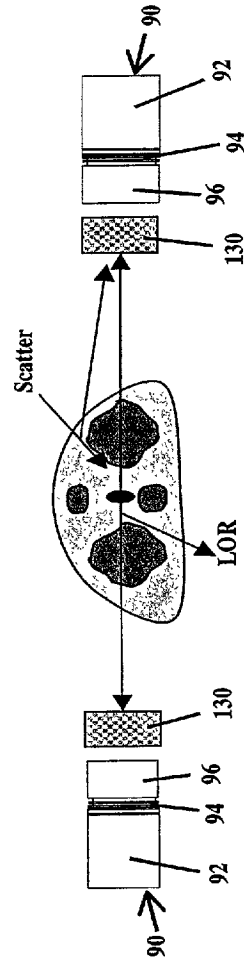
Transmission Attenuation
Map at 511 KEV Energy Level from VCT Images

PET Attenuation Correction



Correction Map for PET New Corrected PET
Projections for OSEM Recon.

PET Scatter Correction



Scatter Correction from VCT Images and
Count Rates on a Projection View Basis

Figure 34

NM/SPECT Transmission, Attenuation & Scatter Correction

VCT Attenuation MAP



Transmission Attenuation
Map at NM/SPECT Energy Levels from VCT Images

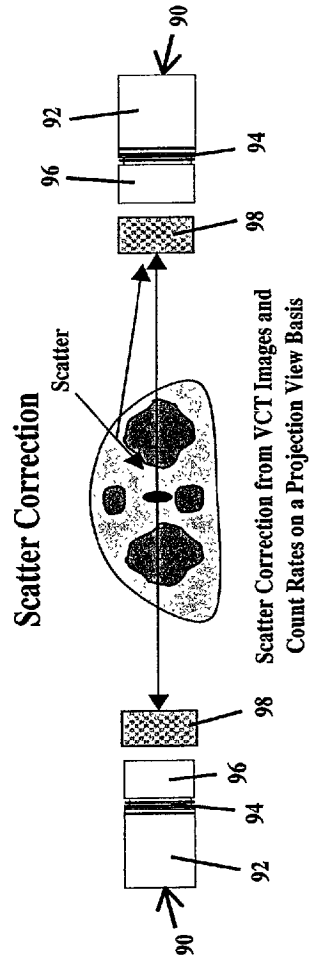
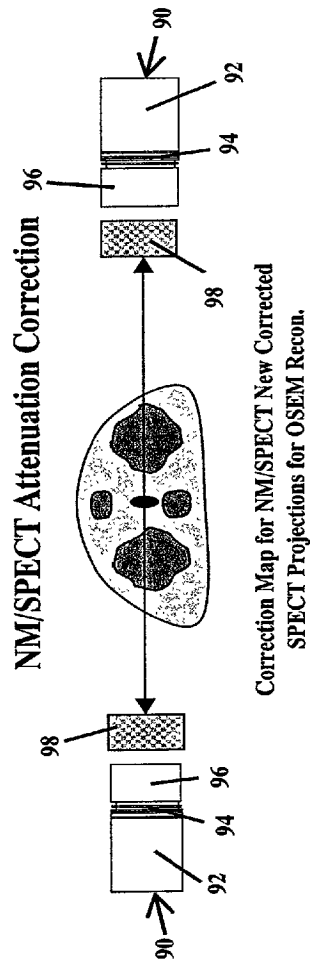


Figure 35

Patient Fused Multi-Modality Imaging and Analysis System

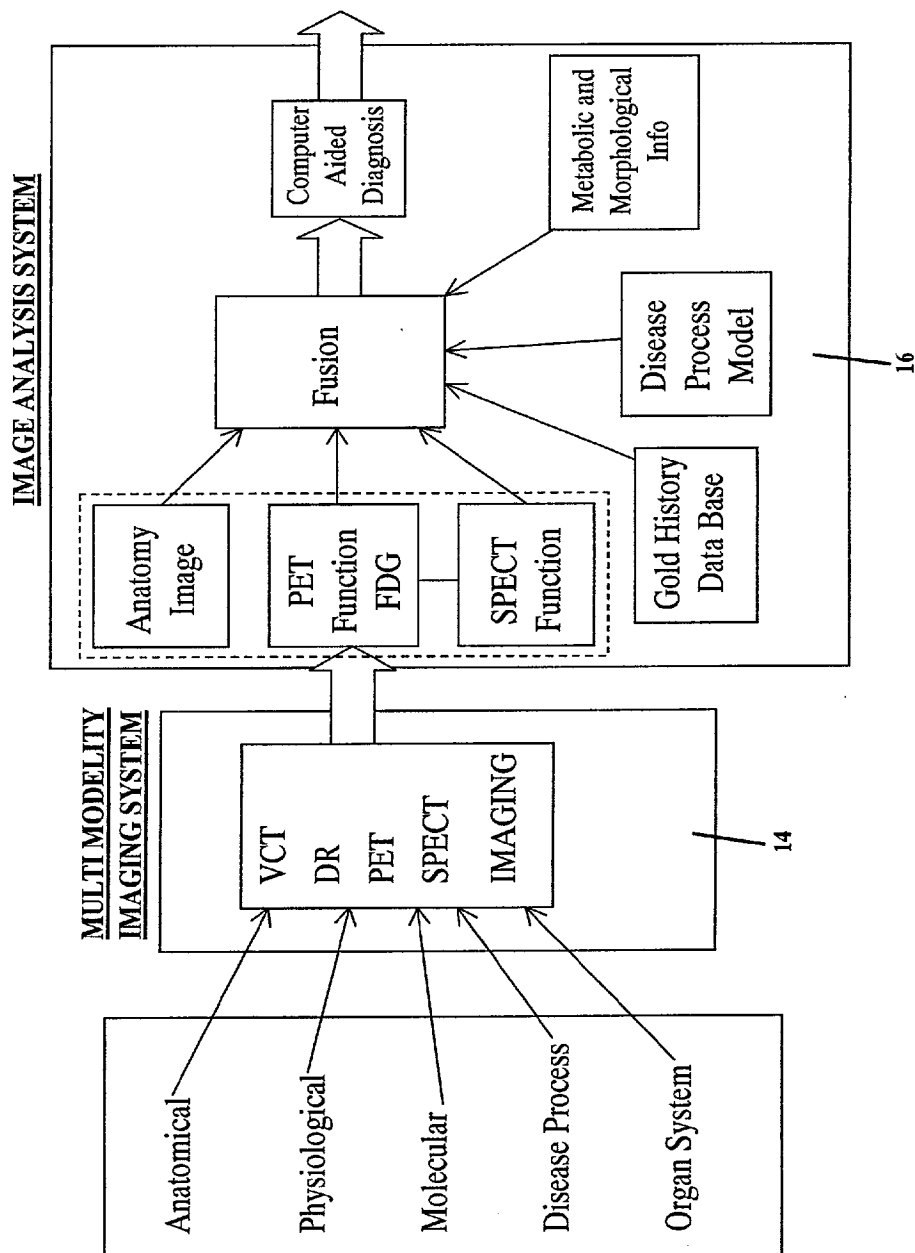


Figure 36

Interventional Image Control System

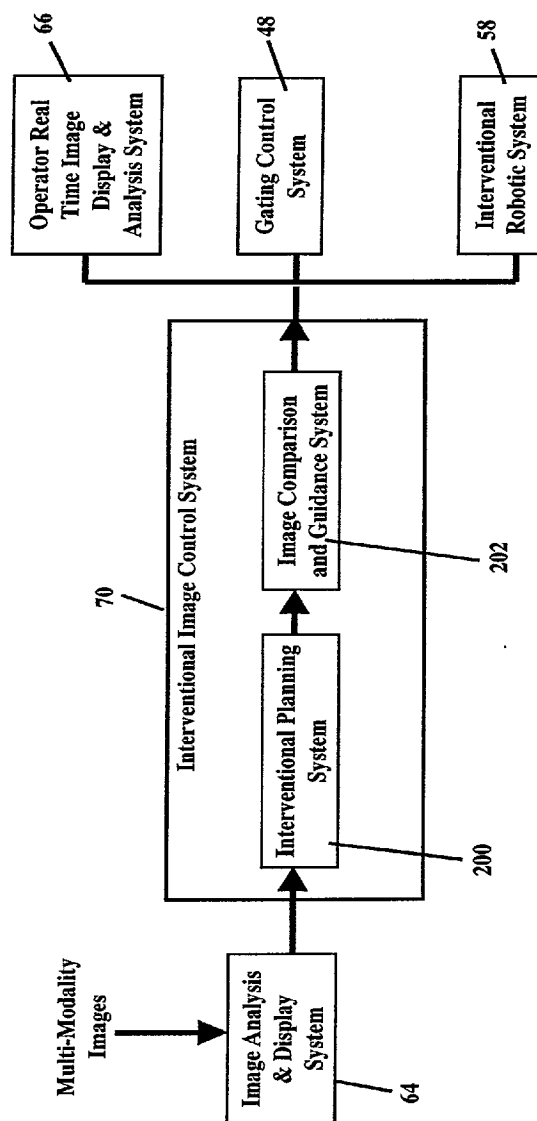


Figure 37

**Multi-Modality Imaging with Independent X-Ray VCT, PET, and
NM/SPECT Image Acquisition System**

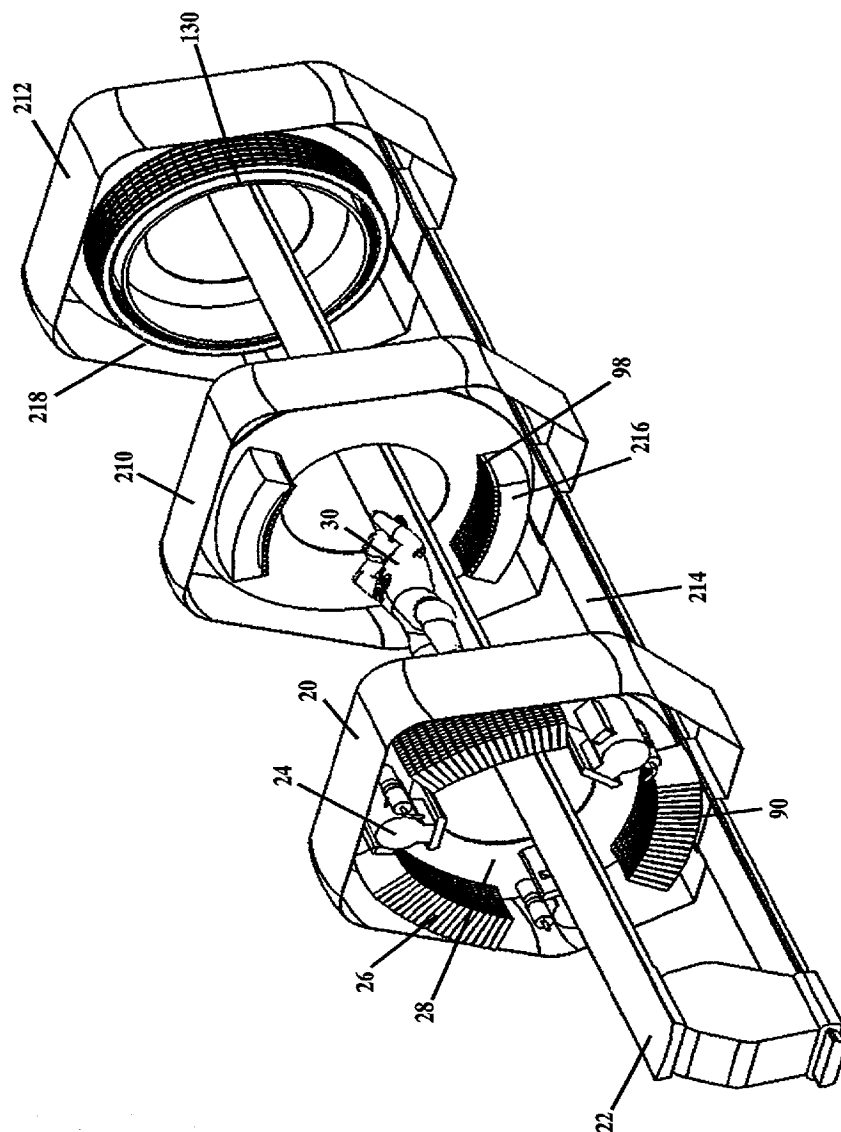


Figure 38

**Multi-Modality Imaging with Independent X-Ray Single Head VCT, PET, and
NM/SPECT Image Acquisition System**

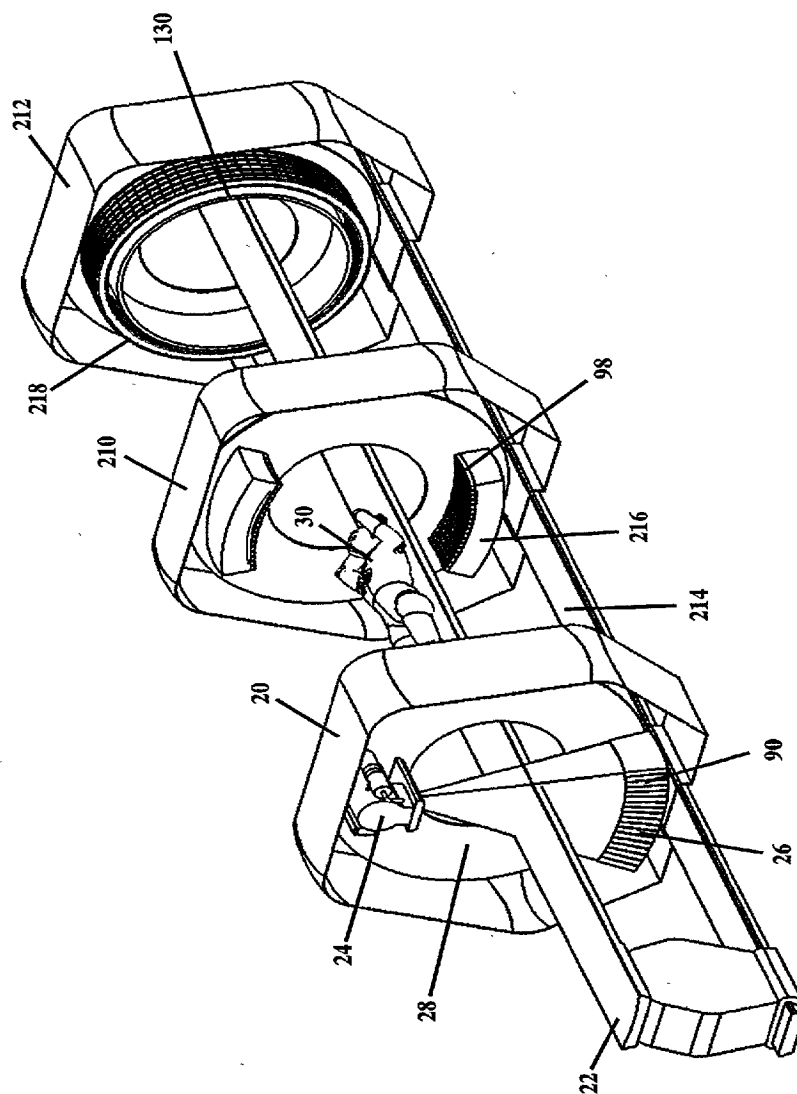


Figure 39

Multi-Modality Imaging System with Stationary
Focused 2D Curved Detector for VCT, PET and NM/SPECT Imaging

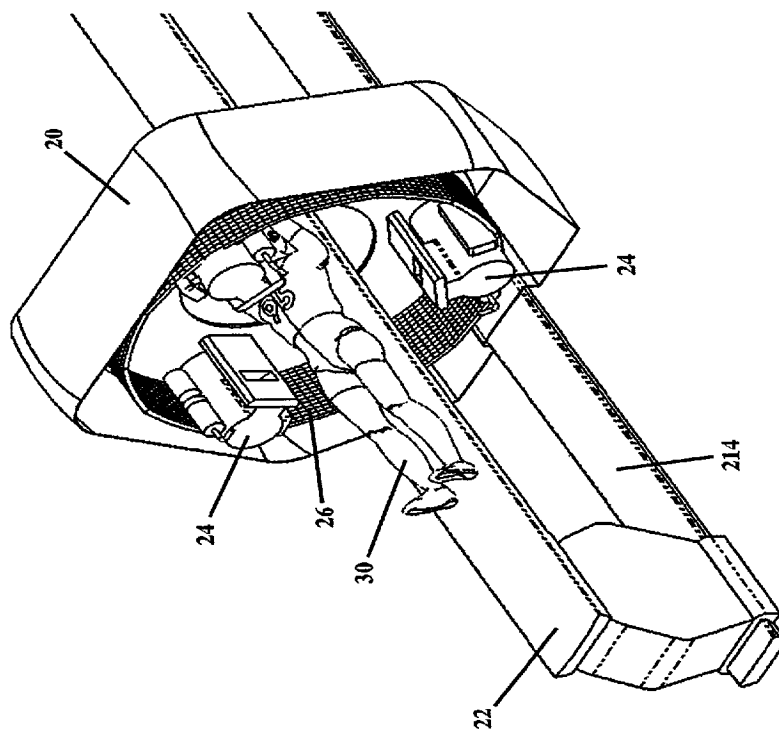


Figure 41



**Multi-Modality Imaging with Common Gantry and Independent X-Ray
Single Head VCT, PET, and NM/SPECT Image Acquisition System**

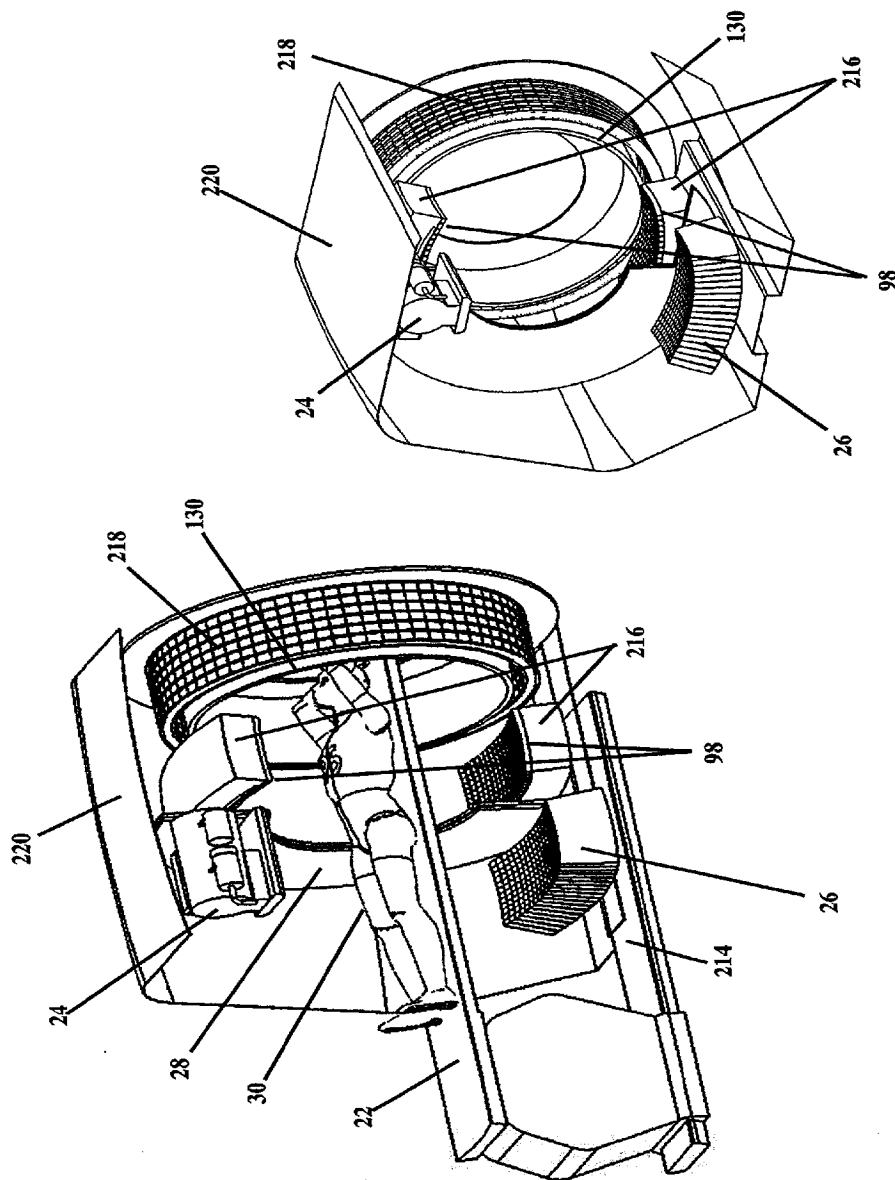


Figure 43

**Multi-Modality Imaging with Common Gantry and Independent X-Ray
4th Generation VCT, PET, and NM/SPECT Image Acquisition System**

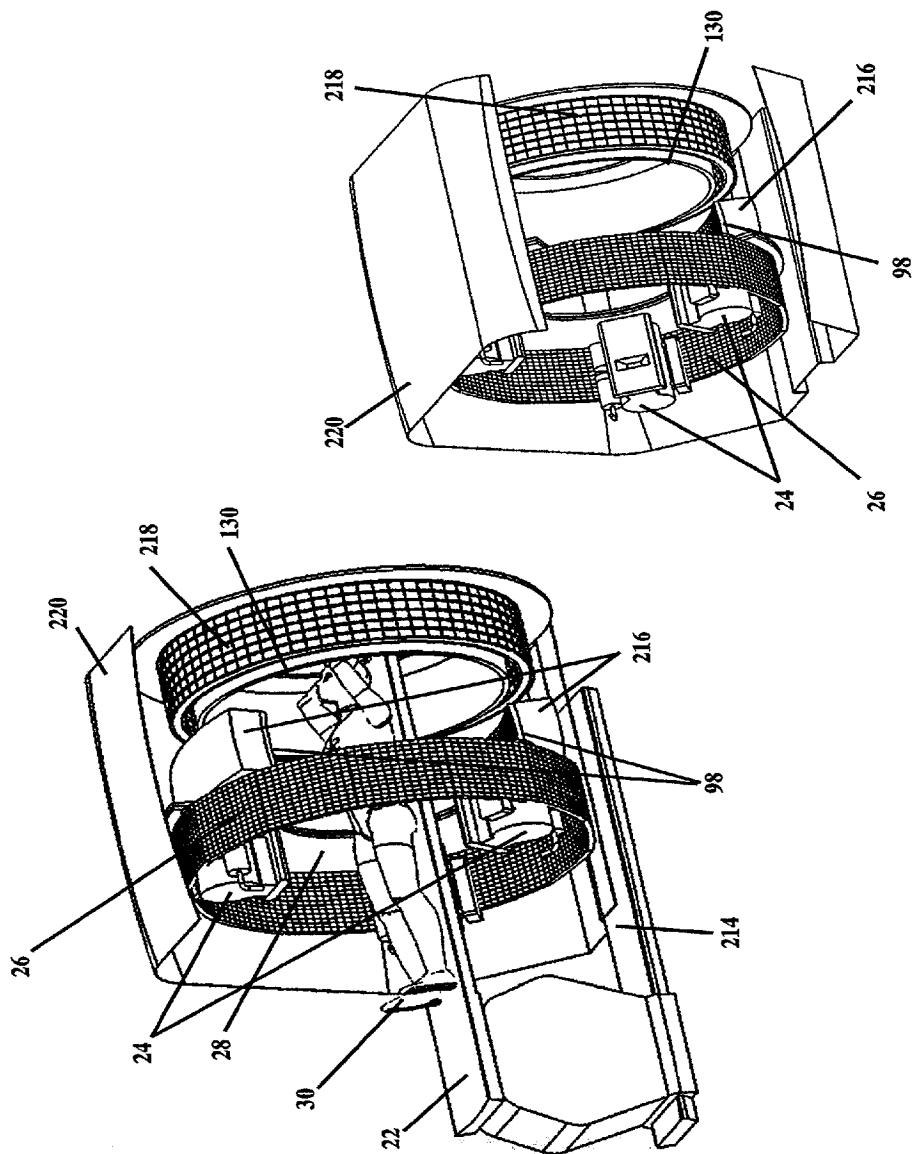


Figure 44

Multi-Modality Imaging with Common Gantry and Independent Single X-Ray 4th Generation VCT, PET, and NM/SPECT Image Acquisition System

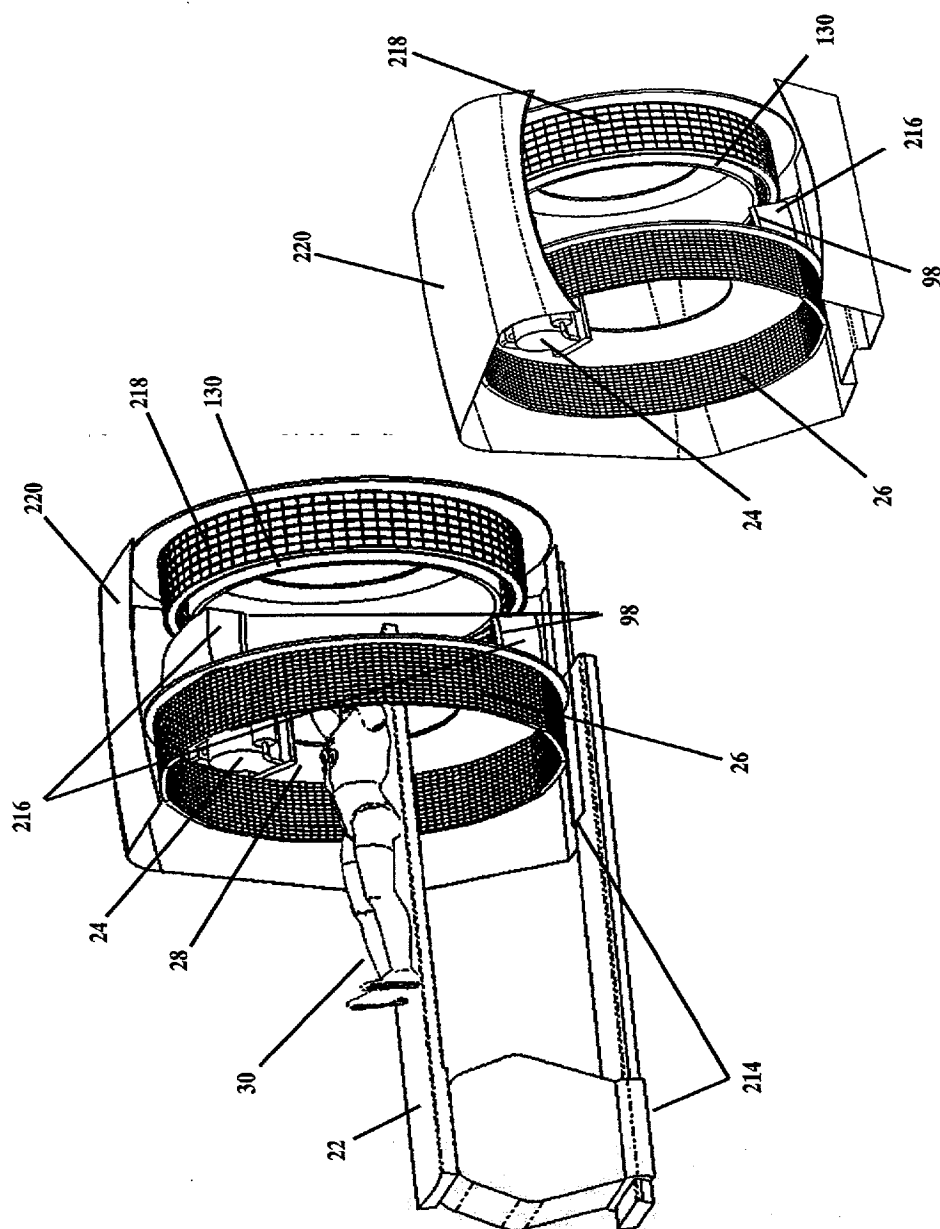


Figure 45